July

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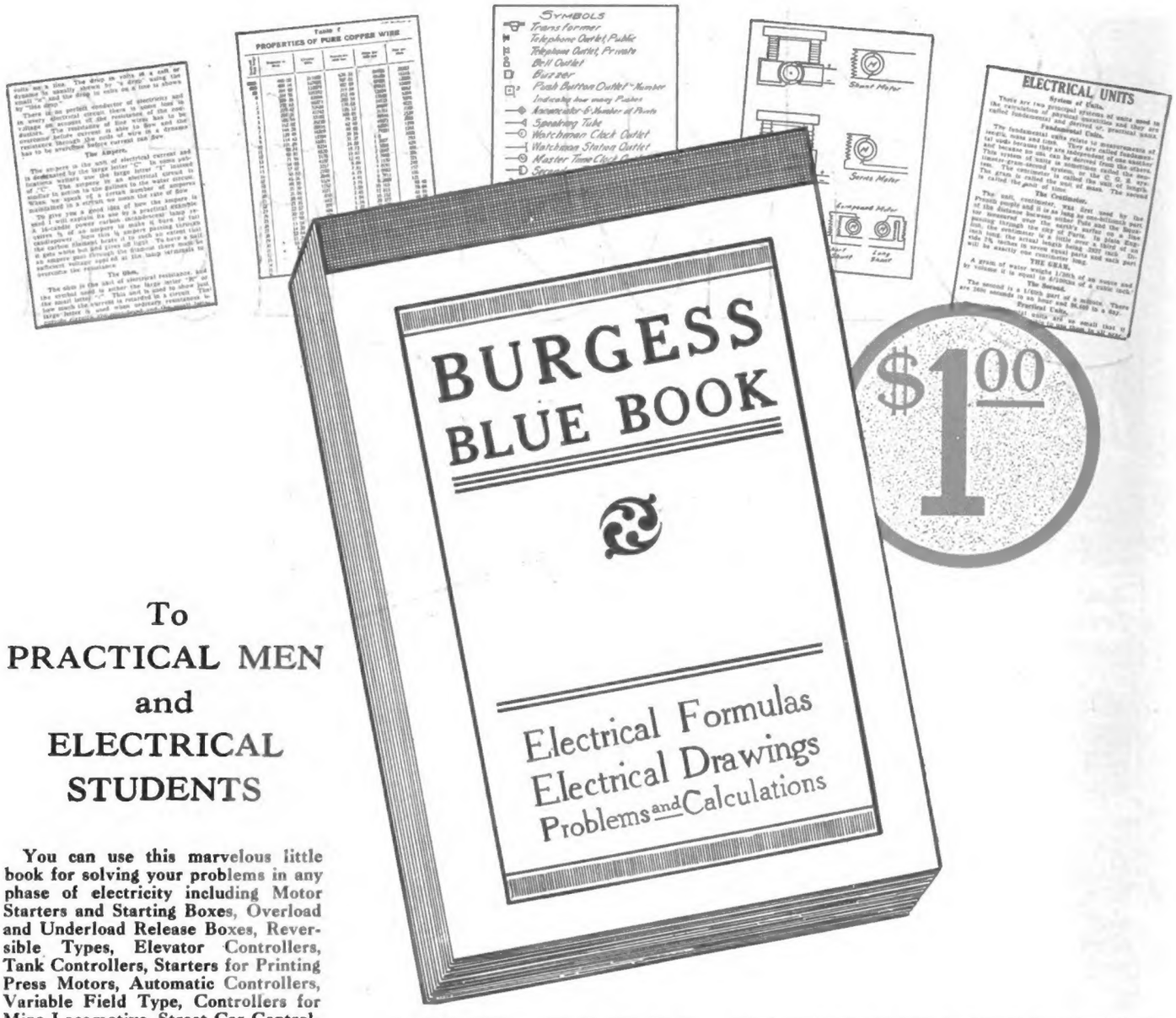

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July, 1926
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IN OUR NEXT ISSUE

How Steam Radiators are Made

There is nothing perhaps more ubiquitous than the cast iron radiator used for heating home or office by steam, hot water or vapor. How do they cast these radiators with hollow interiors, many people ask daily? See the August issue.

How Matches Are Made

How matches are made is more of a question than it might seem at first hand. We visited one of the largest match factories in this country, and will publish in the next issue a very interesting illustrated article on the subject.

Have You Seen the Rowmobile?

This is the very latest vehicle for one or two passengers which travels at a good rate of speed without the aid of storage batteries, motor or gasoline engine. Full working drawings and photos in the August number. Don't miss it!

Expose of Famous Comedy Movie

A very interesting description of how the clever airplane and other startling scenes were photographed in a leading movie comedy now before the public will appear in the August number.

King of Super-Hets!

The greatest of all the Super-Hets will be described and diagrammed.

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LEARN THE SECRETS OF INVENTION USED BY EVERY GREAT INVENTOR

INVENTORS ARE MADE—NOT BORN

Invention is the easiest, most natural function of the human brain. Every idea we have is an invention. The inventor of the O'Sullivan Rubber Heel walked upon hard cement floors all day. These jolts tired him, so he nailed pieces of a heavy rubber mat to his heels.

The young man who thought of putting "hooks" on the upper part of his shoes in place of "eyelets" did it simply because he wanted to save time lacing his shoes in the mornings.

A young man got tired of drawing water from the well with an old chain pump, and devised a "pressure pump" to do this work for him, with a saving of nine-tenths of his muscular energy. This idea is now used in the gasoline-measuring pump of every "filling station" in the country.

These men were not "born inventors"; they were plain every-day folks who applied their minds to practical needs.

WHY MANY INVENTORS NEVER SUCCEED

Many inventors do not succeed because they never patent their ideas, or fail to protect their inventions with the proper evidence of priority, or because they do not make broad enough claims. But the greatest loss sustained is by inventors who fail to fill a real need. The patent office museum in Washington is full of devices which accomplish no really useful purpose; no one wants to manufacture them, because few people would have any use for them. All successful inventors are men who have learned to discern a real need and who invent something which makes people exclaim, "Now, why couldn't I have thought of that?"

STOP GROPING IN THE DARK

Hitherto, every inventor had to work out the principles of invention for himself, often toilsomely, through months and years of discouragement and wasted effort. But now, for the first time, you can actually learn all the principles at once—exactly as other people are learning the principles of electricity, automobile mechanics, law, medicine. For the first time in history, invention is being taught as a *science*, just as Thomas A. Edison once predicted that it would be. The easy-to-learn principles which every great inventor has used have at last been written down in black and white, by Raymond Francis Yates, and 15 other great inventors, and the Bureau of Inventive Science offers them to you in the first course in practical invention ever devised.

WHAT EVERY INVENTOR MUST KNOW

This course begins at the beginning and tells you everything necessary to help you in conceiving, developing, patenting and marketing your inventions. Here are the titles of the 25 inspiring lessons:

Development and Application of Inventive Imagination
Developing the Idea
What an Inventor Should Know About Chemistry
What an Inventor Should Know About Drawing
Collection of Data as an Aid to Research and Invention
Practical Application of Scientific Laws and Principles
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Keeping Legal Records of Research and Invention
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Patent Rights and Their Exploitations
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Miscellaneous Advice

Nothing has been omitted. Everything you need in order to do practical inventive work is taken up step by step, and explained by experienced, successful inventors.

LET 15 INVENTORS SHOW YOU

The authors of this remarkable course have set down, for the first time, the laws and principles of Inventive Science. They have, in brief, actually shown you *how to invent.* In simple, easily understood language they explain how successful inventors work; how ideas are developed and made practical; and how to protect your invention and turn it into dollars when you have made it. Instead of groping blindly for years, learning through painful experience, this information will enable you to develop your ideas quickly, protect them, and find a market for them.

A FORTUNE WITHIN YOUR GRASP

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This Bureau is not connected in any way with patent attorneys or manufacturers. Our only wish is to help ambitious men and women to develop their inventive ability—to become successful inventors.

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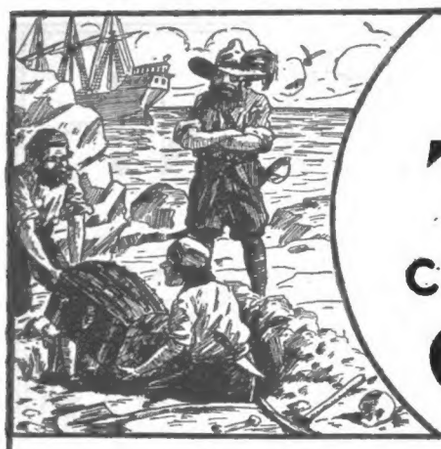

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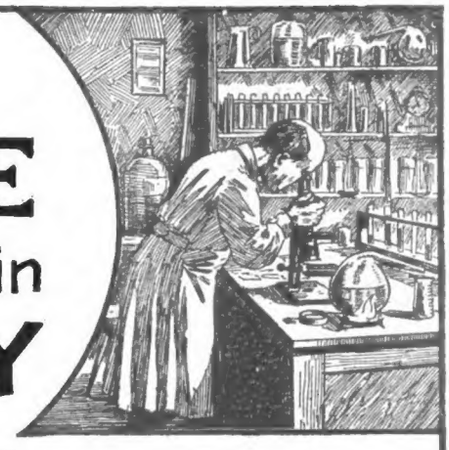

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Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.

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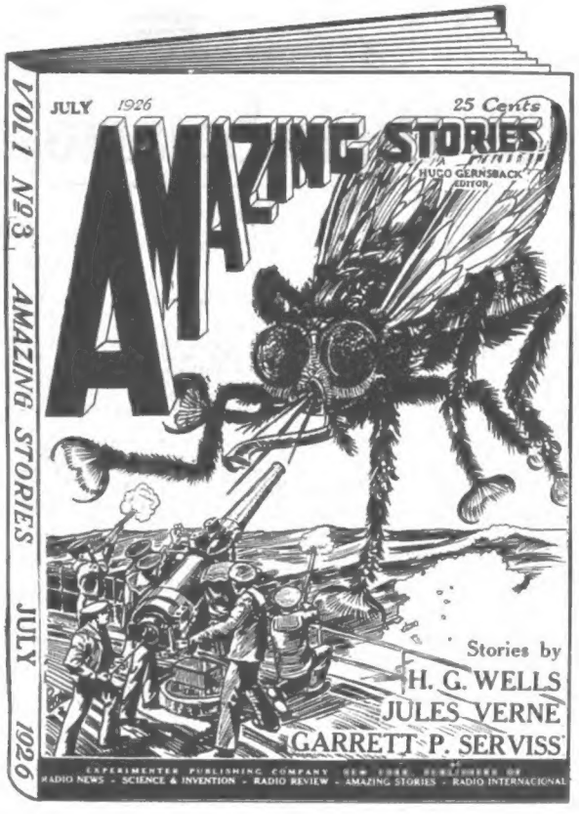
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HUGO GERNSBACK EDITOR
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JULES VERNE
GARRETT P. SERVISS
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Whole No. 159

Science and Invention

July, 1926
No. 3

HUGO GERNSBACK, F.R.S., *Editor-in-Chief*
H. WINFIELD SECOR, E.E., *Managing Editor*
DR. T. O'CONOR, SLOANE, Ph.D., LL.D., *Associate Editor*
Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

WHERE SCIENCE FAILS

By HUGO GERNSBACK, F. R. S.

ONE of the most characteristic features of natural Science is that the more progress is made in it, and the more new inventions and discoveries come along, the less the average person seems to know about it. The reason is, of course, very simple. Science itself, due to the flood of inventions, speeds up our lives to such a tremendous extent that every one of us, in order to compete in the struggle for existence, must become an expert in his chosen calling. If he does not do so, he falls by the wayside.

The average man or woman, as a rule, knows one thing pretty well, but has little conception of what lies outside of his sphere. For instance, the business man in any line of business will probably be well conversant with most subjects that touch his business. Outside of these subjects he seems to have little knowledge and does not seem to care to know what is going on. And this is really a pity, because, though he may not realize it, knowledge, as the saying goes, "never hurts", and it often happens that such acquired knowledge outside one's regular line of work comes in most handy at times when ones business changes or when new and unexpected developments in the same business occur.

To be specific, how many people are aware of scientific progress in the various sciences that is going on day in and day out? How many average individuals could name you the 12 greatest inventions or discoveries for 1925? You will find the percentage amazingly small. But not only that—ask a dozen individuals, so-called intelligent people, a number of absurdly simple science questions and you will find out immediately how the wind blows. Suppose you try the following list on your acquaintances and see how they "stack up" in their knowledge of everyday science. You will find that the average schoolboy or high school student probably fares better than the average business man or business woman, but even the youngsters will give you some surprising answers that assuredly are not "in the book."

Here are the questions:

(1) What materials go into the manufacture of a lead pencil?
(2) What is static?
(3) What is newspaper stock made of?
(4) What is a short-circuit?
(5) How long is the day and night at the north and south poles?
(6) What metals does a magnet attract?
(7) What is the difference between heat and cold?
(8) Why are mountain tops colder than their bases, although nearer to the sun?
(9) What is crude oil?
(10) What is the difference between bacteria and germs?
(11) What is the difference between a musical note and a noise?
(12) Can brown or dark eyed parents have blue eyed off-spring?

These questions, as it will be noted, run the entire gamut of the various branches of science. To the scientific man they are, of course, absurdly simple, even childish. But try them on a crowd of people and ask them to write the answers down, and see what happens. You will be surprised. Incidentally, the questions, correctly answered, will be found in the back of this magazine on page 260.

Of course, most of your friends will tell you that if they wish to know the answers to these questions all they have to do is to look them up in an encyclopedia or in a physics text-book. This is very true, but at best a poor answer. It is not always possible nor convenient to have a text-book at hand. Moreover, many situations arise constantly in all of our lives wherein a little knowledge would do a tremendous amount of good, and the lack of knowledge often will mean a vital difference.

Take such a simple thing as your wife accidentally splashing some grease spots on her new gown. Lack of knowledge probably will induce many people to send the gown to the dry cleaner, while the man or woman who knows a little bit about everyday science or, rather, chemistry, in this instance, will know that there is a common solvent for grease, the name of it being either gasoline or benzine. Very often a perfectly good dress or gown is spoiled by applying the wrong cleanser, because such a cleanser is not a solvent for the particular stain.

But to be a little more specific, when it comes down to your business. A certain concern for years has been manufacturing an item in which it was necessary to cover a bent metal rod with a piece of thin rubber tubing in order to give it protection. The rubber tubing had to be put on by hand, and it was an expensive and difficult method. Six months ago the concern had to discontinue manufacturing the article, because the dealers and stores no longer could afford to pay the high price. After the machinery had all been scrapped and the line discontinued, it was found out, quite by accident, that the article could now be manufactured by *electrically* rubber-plating the article. So the machinery had to be rebuilt, at a cost of thousands of dollars, and the firm now plates the article with rubber at a price considerably below what it was possible to do heretofore. If the president of the corporation had been a reader of some popular scientific magazine, he probably would have seen the article, months ago, and would have obtained the necessary knowledge and so effected a huge saving.

This sort of thing is by no means an isolated case. It happens every day, and only those who refuse to burden themselves with a little excess knowledge are the ones who lose out in the end. There is hardly an establishment in the country that the man of science, who knows his P's and Q's could visit without finding a vast amount of ignorance displayed at every hand. The up-to-date business man who thinks he has all the latest labor-saving devices is not nearly so up-to-date as he believes himself to be, and it is often the man who knows just a little bit more than the rest who forges ahead and passes his competitors.

A well-known radio manufacturer proved this quite a while ago when he applied an old principle to a new business. It was the custom among radio manufacturers to solder *each* wire to the various bus bars and other connecting wires or strips in the radio set. The manufacturer who knew the little bit more, however, applied the spot welding system to the radio set manufacture and built a comparatively simple machine by means of which, *in a single operation*, mind you, it is possible to weld about 30 connections in the space of two seconds—an operation that takes the other manufacturers as long as 30 and 40 minutes to accomplish. Not every one knows about spot welding. It is simply the application of a little scientific knowledge to one's own business that may spell success or failure.

But whether you are a manufacturer or not makes no difference. Some time in life there will arise an occasion when the acquired knowledge will come in handy. Keep prepared and Science will do its bit for you. You should understand things—it is not enough to know where to find books about them. Make a library out of your brain.

THE GOLDEN AGE OF SCIENCE

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Mr. Hugo Gernsback speaks every Monday at 9 P. M. from Station WRNY on various scientific and radio subjects.

First Airplane to Fly to North Pole

By H. WINFIELD SECOR

Wonderful Round Trip to North Pole Made in Fifteen and One-Half Hours by Commander Richard E. Byrd and Floyd Bennett, Pilot.

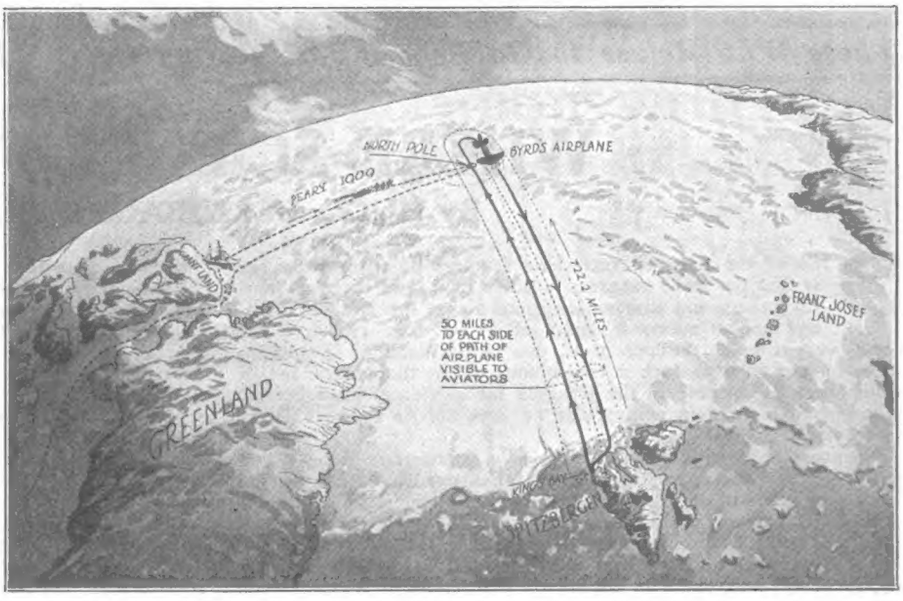
Photo at left is that of Commander Richard E. Byrd, U. S. N., who with Floyd Bennett, his pilot, flew to North Pole and back in airplane.

A FEW weeks ago two intrepid United States flyers, Commander Richard E. Byrd and Floyd Bennett, his pilot, completed in 15½ hours a 1,500-mile journey over the frozen Arctic from Kings Bay, Spitzbergen to the North Pole and back. The direct route followed by these daring flyers is shown in the accompanying photo-diagrams, which also bring out a number of other interesting features, such as the fact that flat landing spaces on the ice were frequently seen in proximity to the Pole, and that no land was sighted on the entire 1,500-mile journey.

Commander Byrd and his flying partner, Floyd Bennett, expert pilot, completed the round trip to the North Pole on May 9th without landing once on the entire journey. The dirigible "Norge" started on her momentous trip over the North Pole to Alaska, shortly after the return of Byrd and Bennett in their triple-engined Fokker airplane, the "Josephine Ford."

As in previous cases of polar explorations, Commander Byrd waited for the spring of the year when the most agreeable climate was liable to be found in the polar regions. He also had the advantage of constant sunlight on the entire trip of 15½ hours.

The Fokker monoplane used by Commander Byrd was built at Hasbrouck Heights, N. J., not far from New York City, while the three wonderful engines which enabled this trip to be completed successfully, are of the type known as the Wright Whirlwind, each engine having nine cylinders of the air-cooled type. The cylinders are of the fixed radial type, and each engine developed 200 horse-power at 1,800 revolutions per minute. These engines are ideal for polar trips as cold does not affect them.



The photo-diagram above shows route followed by Commander Byrd and Floyd Bennett in their startling flight to the North Pole and back from King's Bay, Spitzbergen. The trip was completed in 15½ hours, the distance flown having been about 1,500 miles. As diagram shows the flyers could see fifty miles to either side of the plane. Peary's sled route to the pole in 1909 is also shown.

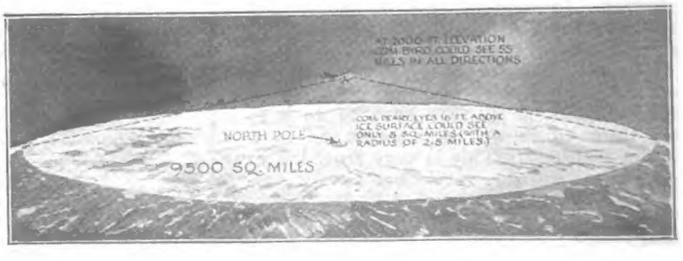
Among the many interesting observations made by Commander Byrd and Floyd Bennett on their trip to the North Pole and return was the fact that many flat landing places on the ice were noted near the North Pole. No land was seen by the flyers. Depth of the water at the pole, as measured by Peary, was 9,000 ft., as indicated above.

Commander Byrd and his companion Floyd Bennett did not depend on the magnetic compass, but used instead a bubble sextant and the new sun compass invented by Albert H. Bumstead of the National Geographic Society. As Mr. Bumstead stated—"The sun is visible for twenty-four hours a day in the summer in the far north. The sun compass used by Commander Byrd depends upon the fact that the sun moves regularly around the sky in twenty-four hours, and by having the clock with a twenty-four-hour dial the pointer can be kept following the sun while the instrument remains in one position.

"If Commander Byrd desired to travel in a due north direction he would set the compass dial for north, and then so maneuver his plane that a shadow thrown along one of the hands of the clock dial would be exactly superimposed upon that hand. This shadow is cast by a projection that rises from the body of the clock hand. The sun compass is very easy to use when the clock has been accurately set to sun time and the sun is visible enough to cast a shadow."

Many people wonder how Commander Byrd knew when he had arrived at the North Pole. He had the distinct advantage of the new bubble sextant, which provides an artificial horizon. Even if the fog obscured the real horizon, the bubble sextant allowed the navigators to ascertain their position by sighting at the sun. A few years ago this would have been a more difficult process, but thanks to the Littlehales' method of calculating positions in the vicinity of the North Pole, the flyers knew their exact position at all times.

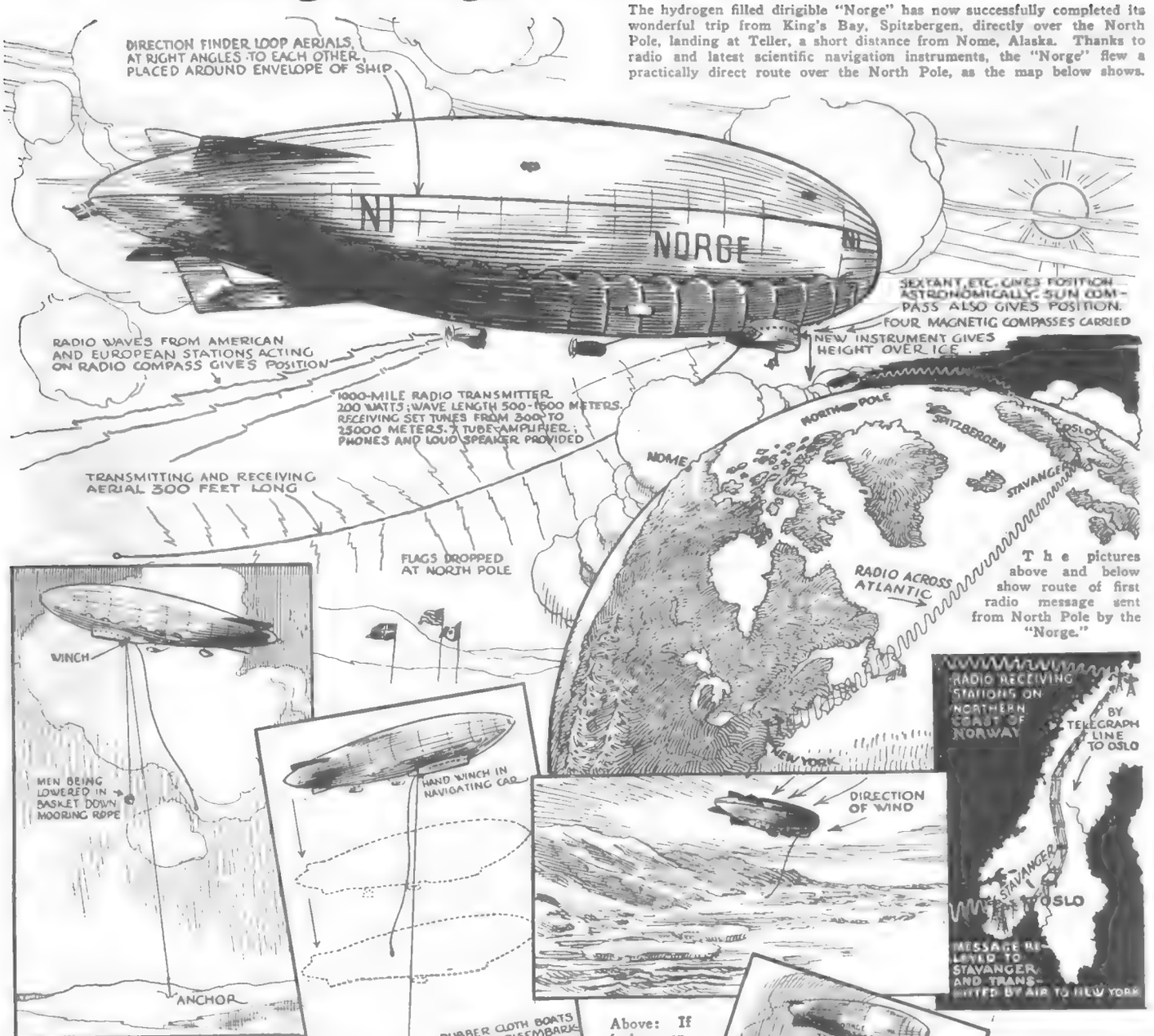
In flying to the Pole, Commander Byrd flew at an average elevation of 2,000 feet, while on the return flight the average elevation was 3,000 feet. In flying back from the Pole, the two birdmen made extra speed with their Fokker monoplane, due to the reduced load of gasoline. New methods of navigation over the polar route were employed by Commander Byrd, notably the use of the new *sun compass* and *Byrd bubble sextant* and a new system of establishing his position at any time, as developed by George Littlehales.



Peary, when he reached the North Pole in 1909, stood on a mound of snow, bringing his eyes to a point sixteen feet above the surface of the ice. Peary could only view an area of 5 square miles while Commander Byrd could view 9,500 square miles, when at an altitude of 2,000 feet. The aerial explorers could see 55 miles in all directions at the pole.

Norge's Flight Over North Pole

The hydrogen filled dirigible "Norge" has now successfully completed its wonderful trip from King's Bay, Spitzbergen, directly over the North Pole, landing at Teller, a short distance from Nome, Alaska. Thanks to radio and latest scientific navigation instruments, the "Norge" flew a practically direct route over the North Pole, as the map below shows.


DIRECTION FINDER LOOP AERIALS, AT RIGHT ANGLES TO EACH OTHER, PLACED AROUND ENVELOPE OF SHIP
NORGE
SEXTANT, ETC. GIVES POSITION ASTRONOMICALLY; SUN COMPASS ALSO GIVES POSITION.
FOUR MAGNETIC COMPASSES CARRIED
NEW INSTRUMENT GIVES HEIGHT OVER ICE
RADIO WAVES FROM AMERICAN AND EUROPEAN STATIONS ACTING ON RADIO COMPASS GIVES POSITION
1000-MILE RADIO TRANSMITTER 200 WATTS; WAVE LENGTH 500-1500 METERS. RECEIVING SET TUNES FROM 300 TO 25000 METERS. 7 TUBE AMPLIFIER; PHONES AND LOUD SPEAKER PROVIDED
TRANSMITTING AND RECEIVING AERIAL 300 FEET LONG
FLAGS DROPPED AT NORTH POLE
NORTH POLE
SPITZBERGEN
OSLO
NOME
STAVANGER
RADIO ACROSS ATLANTIC
NEW YORK
RADIO RECEIVING STATIONS ON NORTHERN COAST OF NORWAY
BY TELEGRAPH LINE TO OSLO
STAVANGER
OSLO
MESSAGE RELAYED TO STAVANGER AND TRANSMITTED BY AIR TO NEW YORK
WINCH
MEN BEING LOWERED IN BASKET DOWN MOORING ROPE
ANCHOR
HAND WINCH IN NAVIGATING CAR
RUBBER CLOTH BOATS USED FOR DISEMBARKING CREW
MOORING BAG FILLED WITH WATER
DIRECTION OF WIND

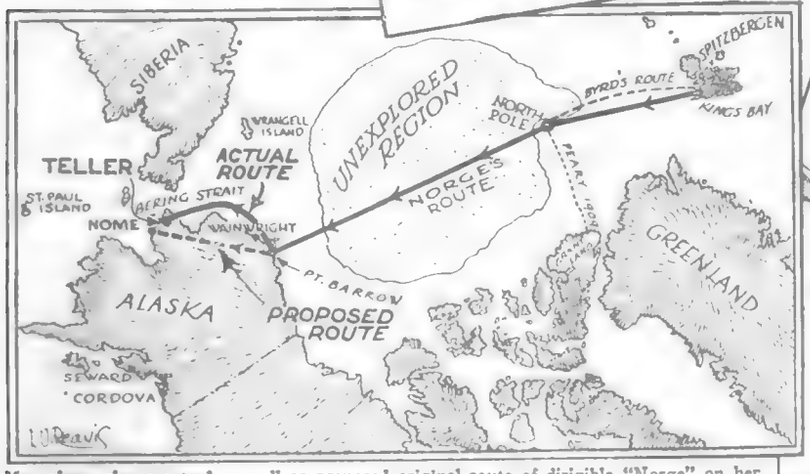
The pictures above and below show route of first radio message sent from North Pole by the "Norge."

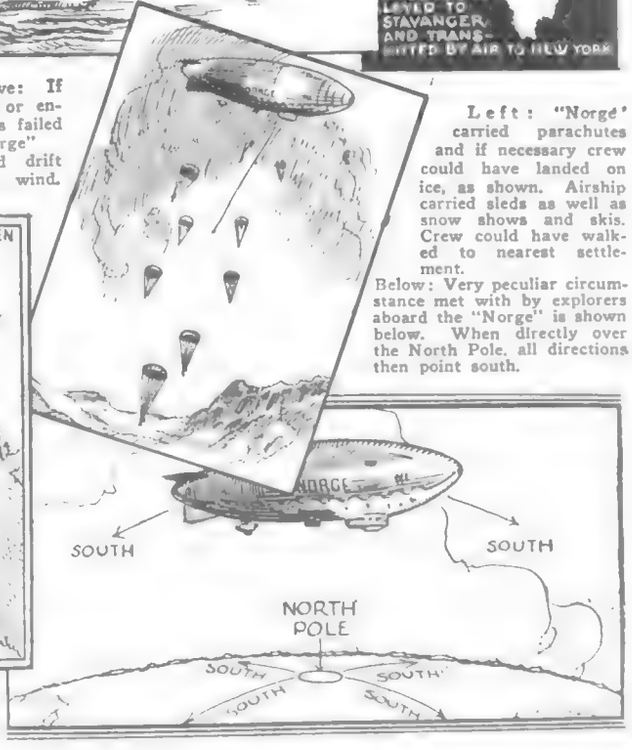
Pictures above and at right show various methods "Norge" was prepared to employ for landing crew and ship. Water bag anchor is clever.

Above: If fuel or engines failed "Norge" could drift with wind.

Left: "Norge" carried parachutes and if necessary crew could have landed on ice, as shown. Airship carried sleds as well as snow shoes and skis. Crew could have walked to nearest settlement.

Below: Very peculiar circumstance met with by explorers aboard the "Norge" is shown below. When directly over the North Pole, all directions then point south.



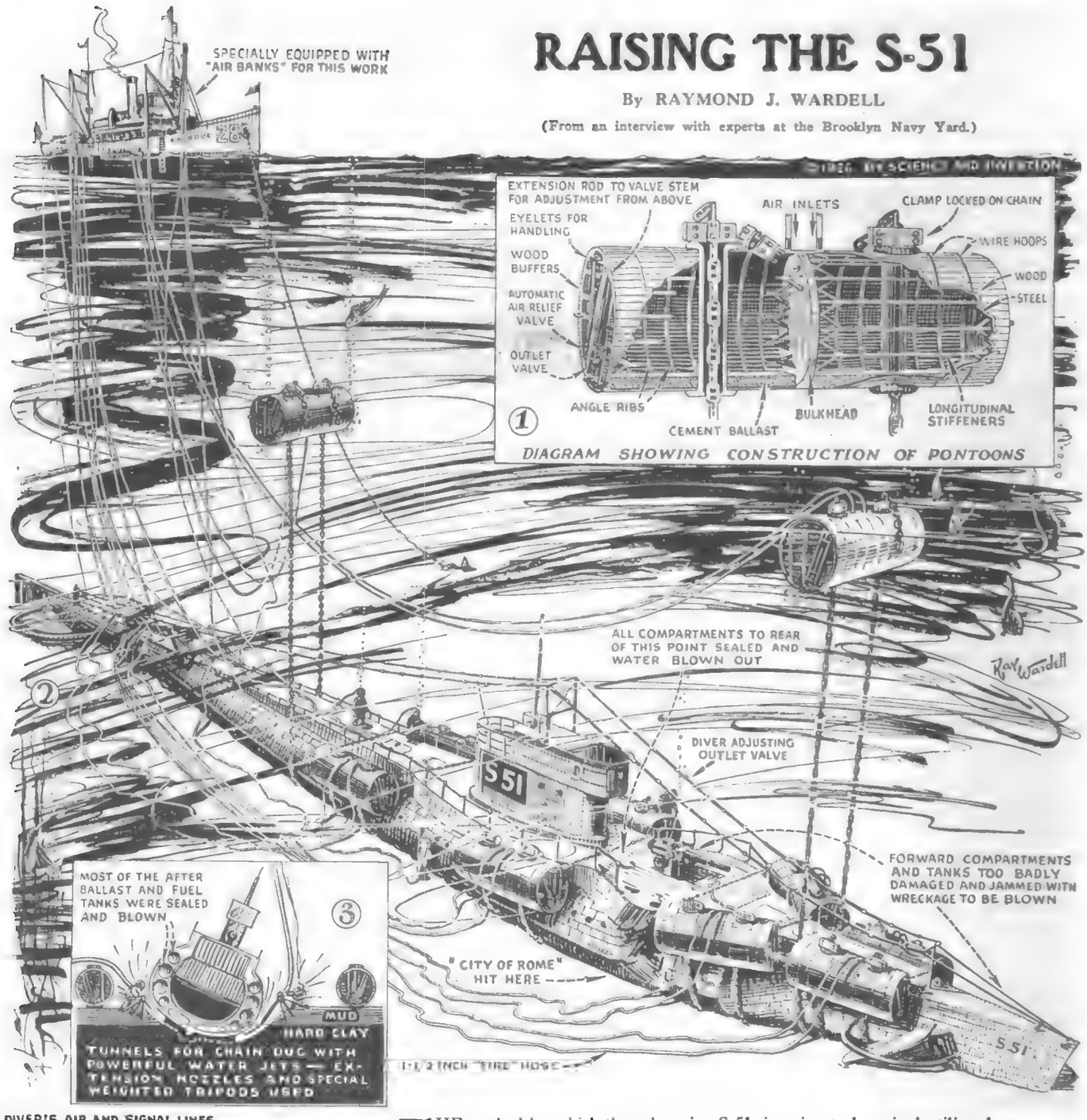


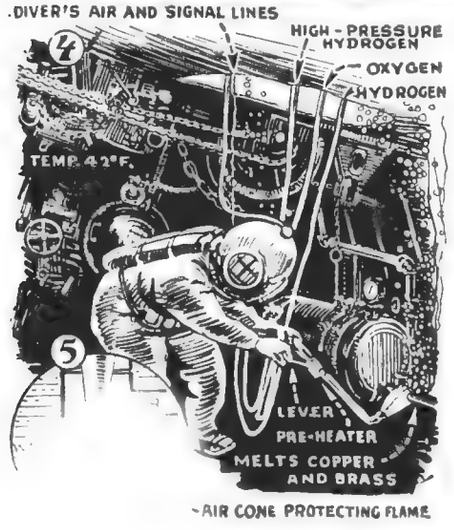
Map above shows actual as well as proposed original route of dirigible "Norge" on her momentous journey from King's Bay, Spitzbergen, over the top of the world where she landed successfully at Teller, Aslaska. The explorers were brought to Nome by motorboat, having to drive a dog team part way.

RAISING THE S-51

By RAYMOND J. WARDELL

(From an interview with experts at the Brooklyn Navy Yard.)


SPECIALLY EQUIPPED WITH "AIR BANKS" FOR THIS WORK
EXTENSION ROD TO VALVE STEM FOR ADJUSTMENT FROM ABOVE
EYELETS FOR HANDLING
WOOD BUFFERS
AUTOMATIC AIR RELIEF VALVE
OUTLET VALVE
AIR INLETS
CLAMP LOCKED ON CHAIN
WIRE HOOPS
WOOD
STEEL
ANGLE RIBS
CEMENT BALLAST
BULKHEAD
LONGITUDINAL STIFFENERS
1
DIAGRAM SHOWING CONSTRUCTION OF PONTOONS
ALL COMPARTMENTS TO REAR OF THIS POINT SEALED AND WATER BLOWN OUT
2
DIVER ADJUSTING OUTLET VALVE
S51
FORWARD COMPARTMENTS AND TANKS TOO BADLY DAMAGED AND JAMMED WITH WRECKAGE TO BE BLOWN
"CITY OF ROME" HIT HERE
1-1/2 INCH "FIRE" HOSE
MOST OF THE AFTER BALLAST AND FUEL TANKS WERE SEALED AND BLOWN
3
MUD
HARD CLAY
TUNNELS FOR CHAIN DUG WITH POWERFUL WATER JETS — EXTENSION NOZZLES AND SPECIAL WEIGHTED TRIPODS USED



THE method by which the submarine S-51, is going to be raised utilizes buoyancy tanks or pontoons, in addition to the bouyancy created by blowing out the water from most of the S-51's compartments. Fig. 1 shows large wood covered steel pontoons which are sunk into position along the sides of the submarine by filling them with water. When the time comes to attempt raising a sunken ship in this manner, the water is blown out of the tanks by compressed air sent down into the tanks through one and one-half inch fire hose lines. These lead to the surface, where they are connected to a large number of compressed air storage tanks aboard the tender ship. Note how the heavy lifting chains are anchored to the buoyancy tanks through large steel tubes passing diametrically through the tanks. Each pontoon is fitted with automatic relief valves, so that excess pressure can leak off through these valves as the pontoons rise with their load. The two pontoons anchored halfway to the surface by chains, will cease lifting when they broach or reach the surface, thus checking any further upward lift of the submarine. If all of the pontoons were sunk to the level of the hull, the ship would come up with a rush, and in this way accurate control of the whole lifting operation is obtained. When the submarine rises to within sixty feet of the surface the suspended wreck will be towed into shallow water. Here a new bite will be taken by flooding the pontoons and allowing them to raise the submarine again. By repeating this operation the submarine will be eventually raised to the surface and put into drydock. Fig. 3 shows how high pressure water jets are used in order to clear a passage through the mud around the midship section, so that chains can be passed around the hull. Figs. 4 and 5 show details of the improved oxy-hydrogen blowpipe used for cutting steel and other metals under water. A cone of compressed air keeps the water away from the flame and for melting copper and brass, an extra high pressure hydrogen line is provided.

$25.00 Prize for Human Aura Photo

NEW WAYS OF SEEING THE HUMAN AURA.

By FENN GERMER

IT is fairly easy to see the Human Aura —that peculiar atmosphere that surrounds each one of us, and which clairvoyants and psychic mediums say mirrors all our emotions in movement and color. It is so easy that it is a wonder that more people have not seen it without looking for it. A great many have, in fact, for those to whom I have attempted to show it have often confessed to having seen it before, but thought it was an illusion. The colors are not so easily seen.

So in the first place it will be necessary to define what the Aura is, and what it is not. Then, when we look for it, we will not get excited over an after-image and say that we have seen the Aura. Not everyone can see it, of course. Thinkers, artists, musicians, etc., are generally more sensitive than others.

WHAT THE HUMAN AURA IS

The Human Aura is a haze, a mist, a gaseous appearance that surrounds the human body on all sides. It is usually restricted to a space within a foot of the body, but on speakers of considerable emotional power (like a football coach I have seen) it may expand out three or four feet while they are delivering a stirring lecture. Ordinarily, however, we do not see the full extent of the Aura; we generally see only the denser brighter portion which extends about 2 to 5 inches from the body.

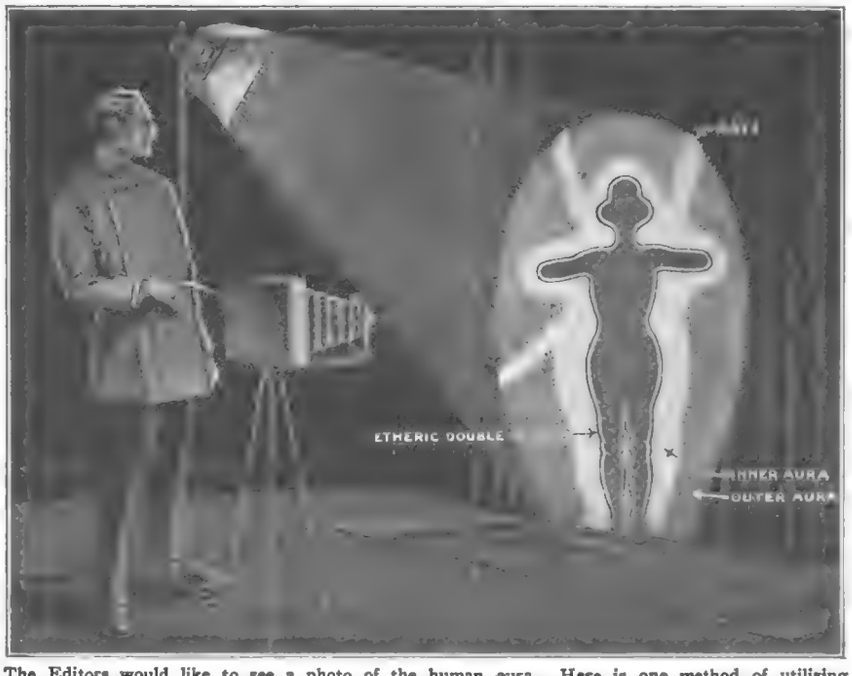
Very close to the body, about ⅛ of an inch thick, lies a grayish-violet line, the clearest and most definite part of the Aura. It looks like a "solid" gas, and is called the "Etheric Double" or "Etheric Body," because it is supposed to be the over-lapping or extension of a body almost exactly like our physical body except that it is made of much finer "etheric" matter which enables it to permeate the physical matter of our body and to seemingly exist in the same space. As this matter is supposed to be very tenuous—as much finer and more active than a gas as a gas is than a liquid—the activity of its particles causes the Etheric Body to press outwards a little further than the physical matter of the body, and thus we have the overlapping phenomenon.

THE INNER AURA

Extending out further than the Etheric Body lies the "Inner Aura," which has a colorless appearance as ordinarily seen, and which is sometimes called the "Health Aura" because the radiating energy of which it is the expression forms striations or lines like thick hairs which stand out at right angles to the surface of the body when the person is in good health, and droop when he is tired or in ill-health. This portion of the Aura is quite clear and presents an appearance similar to the heated air over a radiator although it does not tremble. As usually seen by inexperienced persons under unfavorable conditions, it extends from 1 to 2 inches from the body all around; but under better conditions, or when seen by a person accustomed to observing it, it is often seen to extend from 6 to 12 inches all around and sometimes more. The striations are usually seen only by the more sensitive observers.

THE OUTER AURA

Yet further extends the "Outer Aura," which is almost invisible and can be seen only under the most favorable conditions, so we will not deal with it except briefly. It may extend from 1 to 3 feet out from the body.



The Editors would like to see a photo of the human aura. Here is one method of utilizing ultra-violet rays, whereby it will probably become possible to photograph the aura. Other hints are given in the very fine article herewith, written by a keen student of the subject.

The means required to see the Aura are very simple and elementary. The first requisite is that the experimenter determine beforehand not to be led astray in his enthusiasm by any sort of illusion, as this is a very disappointing pitfall for one who is not used to observing the delicate phenomena. The second requisite is a suitable background, which should always be matt (that is, unpolished, like the surface of calcimine or velvet) unless otherwise specified, and as free from decorations or marks as possible. Decorations or marks on the background distract the attention and make it difficult to focus the eye properly on the air near the body. The best backgrounds are black velvet or velveteen; and, if in a diffused indirect light, white polished tile or porcelain. The black velvet, especially if made into a booth large enough to contain the whole body with outstretched arms, is best for detailed study and for carrying out Dr. Walter Kilner's experiments mentioned later on; the white tile is best for learning how to look for and see the Aura. One can easily see the etheric body and the aura around one's hand when washing in a porcelain washbowl, and a dim light is particularly favorable. Other good backgrounds are yellow, cream-colored, and blue calcimine. Green and orange are permissible too, the only unfavorable colors being red and brown. The background need not necessarily be calcimine, although that is best because there is almost no direct reflection of light to interfere with seeing the Aura. It may be marble, or colored wall-paper without design, or cloth without sheen, etc. The colors should be as light as possible, for a very dark background, with the exception of dead black, tends to render the Aura invisible. This is probably because dark colors absorb much light, and therefore reflect little back through the Aura. There is one exception to this, which is that if one stands in a balcony three or four stories above a sidewalk or an asphalt pavement —a cloudy day is best —one can look down on human beings, dogs, cats, horses, etc., and see them walking about in an envelope of mist or gas. This strikes one as very comical on first sight. The visibility of the Aura under these circumstances is probably due to the fact that when we look down on it, we see a much greater thickness of it than when we look at it from the front or the side. It is like seeing the effect of the atmosphere on the sun; when it is high in the heavens there is little atmosphere to pass through and it appears bright, but when it gets down near the horizon, the greater thickness of the intervening atmosphere begins to reveal itself in dimming the sun's light to a deep red.

THE USE OF COLORED SCREENS

The Aura can also be seen by observing it through chemical or colored screens. Dr. Walter Kilner in his book "The Human Atmosphere" describes a screen made up of a glass water-cell (such as that used in lantern-slide machines to project the reactions of chemicals in solution) with thin glass sides, in which is put a solution of dicyanin (a rare coal-tar dye used in sensitizing photographic plates to infra-red light) in pure alcohol. He advises the use of two solutions, one rather light in color, the other dark. To use these screens, one first looks through the dark one at some source of daylight for two or three minutes; then one turns to look at the person whose Aura is being examined and who must be standing a short way in front of a black velvet background, either through the lighter screen or without any screen at all. The light should be dim and may be adjusted by raising or lowering a window shade. The observer should always have his back to the window when observing the Aura.

Dr. Kilner gives methods of seeing the colors in the Aura, but as they are rather complicated and not likely to succeed in the hands of an amateur, I refer those interested in his book, which is published by E. P. Dutton & Company, New York City. Simply stated, he creates a complementary-colored after-image in the eye by the use of a colored band of paper; then he looks

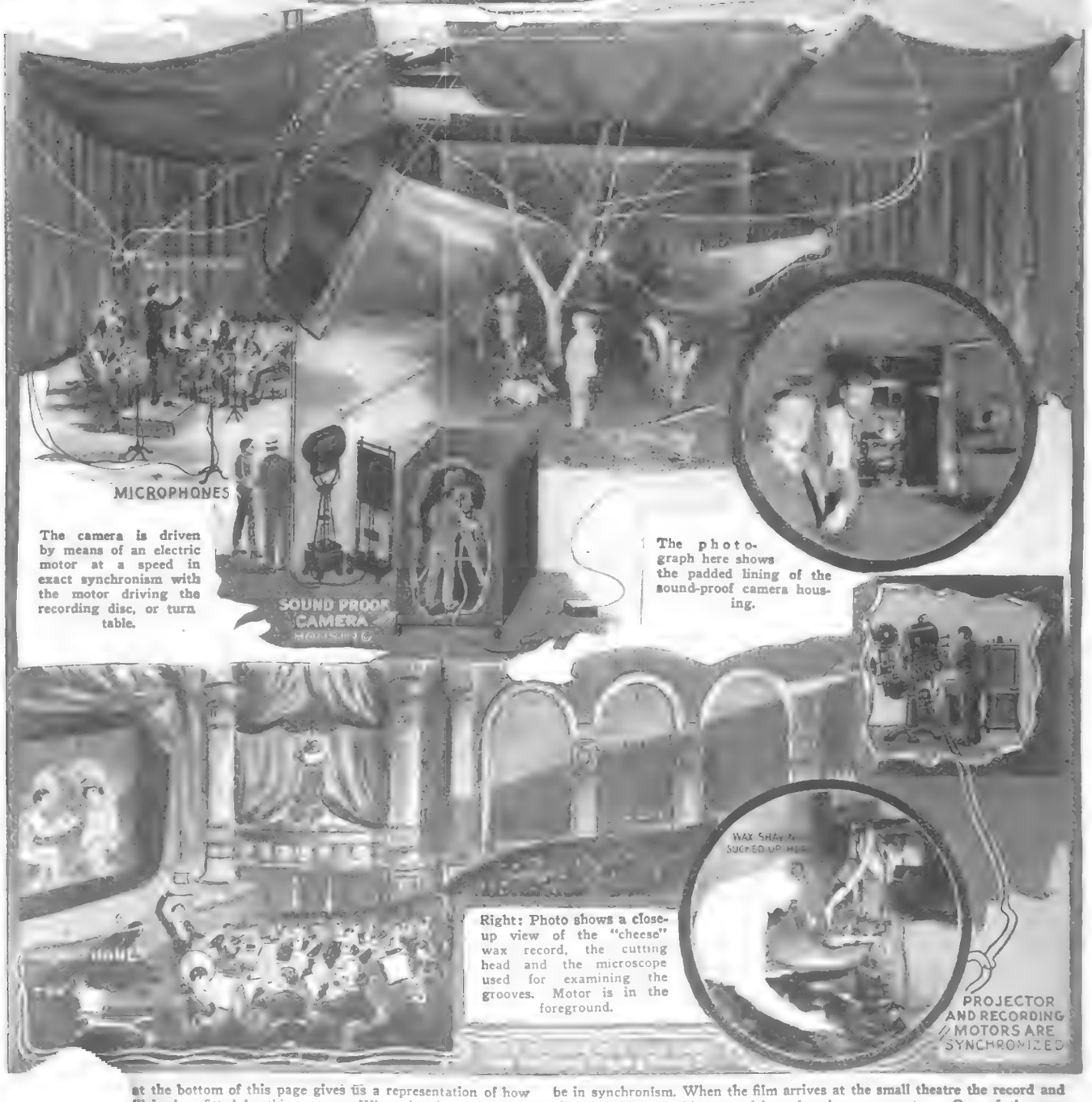
(*Continued on page* 275)

Synchronizing Voice and Movies

By JOSEPH H. KRAUS

ONE of the most recent of the scientific developments which will revolutionize the exhibition of motion pictures in small theatres in little towns has just been announced as having been perfected. The developments are the result of research in the Bell Telephone Laboratories, The American Telephone & Telegraph Company and The Western Electric Company, who have been working upon this system for the Warner Bros. Pictures, Inc. By this system it is possible to synchronize the motion pictures with the reproduced sound, and have that sound perfectly natural. The photograph at the right shows a scene at the recording laboratory. The music and songs may be picked up from more than one remote place and may be made to act on the record after being carefully mixed in the mixing panel.

THE particular scene depicted on this page is one in which a duet is being sung. Microphones are seen suspended overhead but will not appear in the finished picture. They could, of course, be concealed in the scenery. The heavy curtains overhead prevent echoes. The sound is picked up by the microphones and then transmitted by wire to the amplifying panel, from which the amplified sound goes to the cutting needle and is recorded on a thick, cheese-like record. The man standing is examining the grooves.



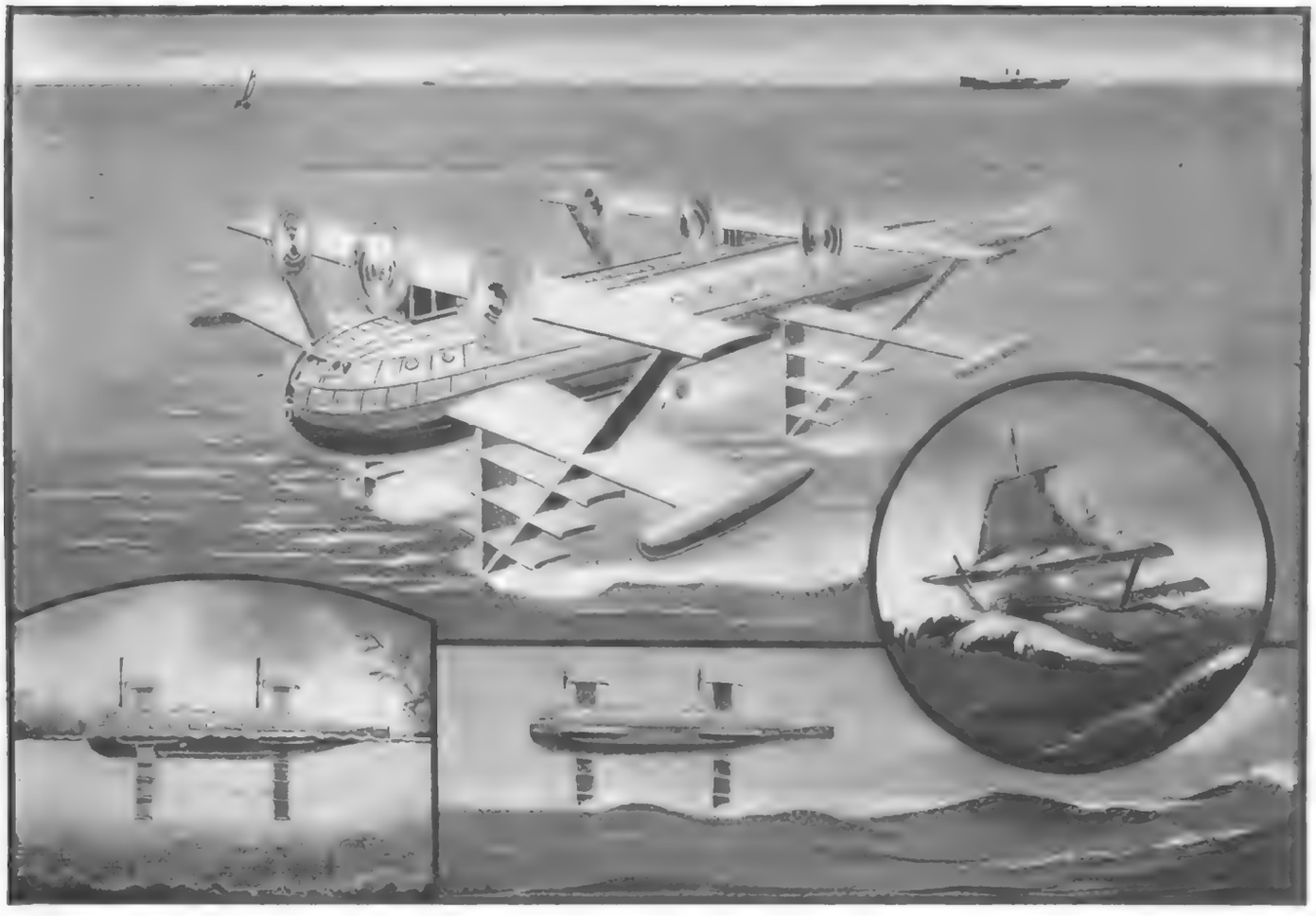
The camera is driven by means of an electric motor at a speed in exact synchronism with the motor driving the recording disc, or turn table.

The photograph here shows the padded lining of the sound-proof camera housing.

Right: Photo shows a close-up view of the "cheese" wax record, the cutting head and the microscope used for examining the grooves. Motor is in the foreground.

at the bottom of this page gives us a representation of how ll be benefitted by this system. When the show comes to nest orchestras will record the music for the picture. This e in a studio but can be done in a theatre and the orches- up can be relayed to a distant recording laboratory. The required is that the recording and projection motors must be in synchronism. When the film arrives at the small theatre the record and the projection machine are driven by the same motor. One of the new types of phonographs which employ vacuum tube amplifiers is used to reproduce the music and in this way the audience at the town theatre will get the benefit of an orchestra of unusual size. Talking pictures do not present enough appeal to warrant feature films to be made, but the music present enough appeal to warrant feature films, but the music is necessary.

Aero-Hydro Glider

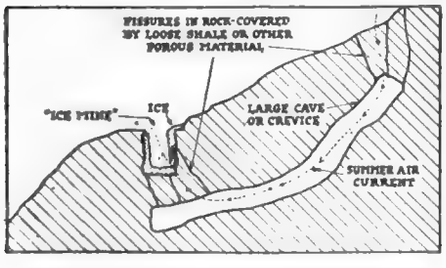


The conveyance illustrated in the diagram above is capable of a speed of 150 miles per hour over the surface of water and can carry a large number of passengers. It rises on the water until the lowest hydrofoils are in the water, while a large percentage of the lift is obtained from the air foils as well as the hydrofoils in the air. It is driven by means of propellers coupled to airplane engines. It is possible at the present time to construct a craft of this type large enough to cross the Atlantic at an average speed of 120 miles per hour, which is greater than the speed attained in actual flight. Because its skims the water it is entirely safe. Emergency sails are provided in event of engine failure. The propellers are of the regular aerial type.

—F. E. LOUDY, Aeronautical Engineer.

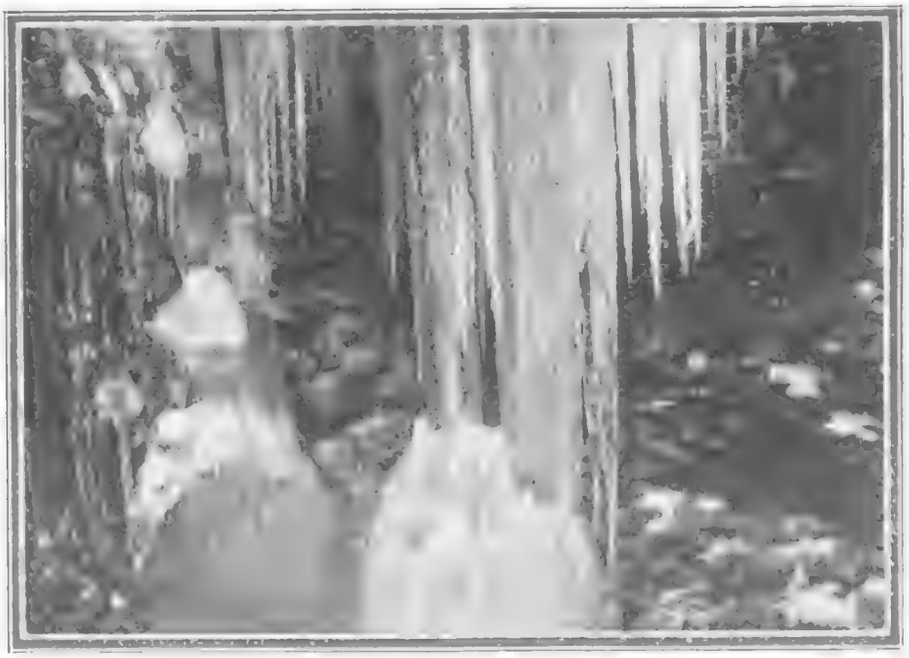
A Natural Ice Mine

IN this ice mine the ice-forming process starts soon after the close of winter. The temperature inside is below freezing in the summer and higher than the surrounding temperature in the winter. The icicles are fifteen to twenty feet long. During warm weather a heavy fog-like vapor is seen to rise from holes in the ground near the mine. A very strong out-draft can be noticed at



A schematic diagram of the ice mine is seen in the diagram above. Note ice formation.

the mine in the summer. The theory is that small fissures in the rock lead from the pit to some point higher up the hill. In the spring the outside air being warmer, causes a current of cold air to come down and out the shaft. Warm air drawn in at the top is chilled to such an extent that it will freeze any moisture in the mine.



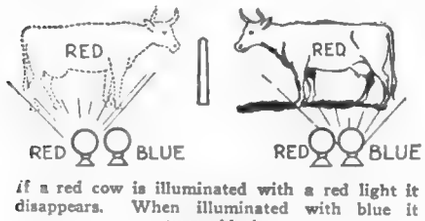
Here is an actual photograph of the ice mine at Sweden Valley near Coudersport, Pennsylvania. The ice lasts all summer and melts during the winter. The shaft is ten by twelve feet at the top and almost forty feet deep.—R. M. Holland. *Photos courtesy Coudersport Ice Mine Co.*

Colored Lights Transform Scenery

The two small inserts immediately above show how it is possible to change the facial expression of one poster. The illustration assumes the aspect above when red light illuminates it, and that at the left when blue light is substituted

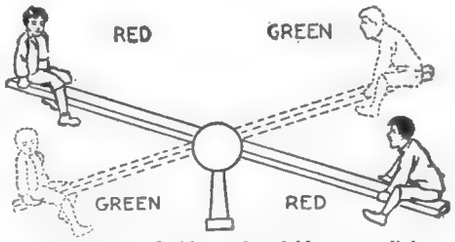
Our artist has depicted a winter stage scene in the larger illustration at the top of this page. Snow may be seen on the trees and on a pile, as well as on a log in the foreground. The actress is attired in a winter costume, and this is exactly how this scene would appear when a blue-green light is thrown upon the setting. If this blue-green light is now extinguished the scene immediately changes to a summer effect, the girl being attired in a bathing suit.

ONE of the most remarkable methods for the production of apparent motion is that of employing a series of colored lights for the production of the effect. This system is not a new far-fetched idea; it is actually being employed at the present time for animating painted colored signs. There are several ways of producing this motion and two examples of the systems are illustrated in the diagrams at the bottom of this page. In the one at the left, two bulls are seen on opposite sides of a fence. These are both painted red. Now when a red light is flashed upon either bull, it disappears. At the same time that the light is flashed upon the bull on one side of the fence, a blue-green light illuminates the bull on the other side of the fence, making it visible and producing a black color. The retention of vision produces the illusion of the bull actually leaping over the fence. In the figure at right, the see-saw is made to apparently swing up and down.



If a red cow is illuminated with a red light it disappears. When illuminated with blue it turns black.
Courtesy of Color Animation Corporation.

This particular system is of extraordinary value in stage effects. For instance, a winter scene can be instantaneously converted to a summer beach scene, the snow disappearing entirely, the hills of ice being converted to the waters of the beach, and a pile of snow in the foreground becomes converted into a bathhouse. Even the girl's costume miraculously disappears from her back and she stands there in a one-piece bathing suit or even less if the management so desires. By means of these lights, costumes can be made to appear and disappear. The outer garments of the girl are made of cellophan, or red gelatine. When this is illuminated by a blue-green light it becomes opaque and jet black. The instant that a red light is flashed upon the costume it becomes as transparent as a sheet of glass.

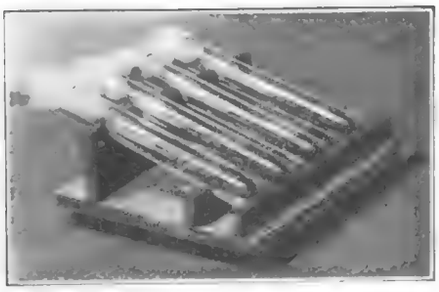


By alternately flashing red and blue-green light at the figures, they may be made to move.

Bottle Feeding the Orchid

Cattleya and Its Hybrids

By DR. ERNEST BADE

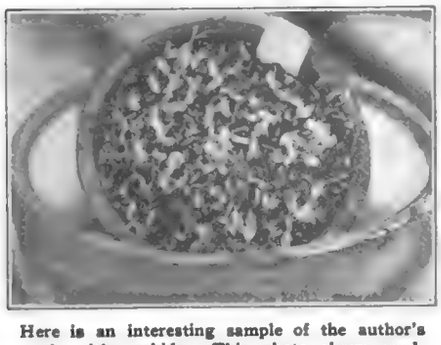


In the photo above we see how the author arranges orchid seedlings in glass test tubes with a tuft of cotton in the top of each tube.

THE most important orchids used as cut flowers today include all of the many species of Cattleya. The flowers of Cattleya are well built, large, and exceptionally vivid and peculiarly showy in tint so that they attract instant attention. These flowery fantasies are more wonderful than the most extraordinary vision of the imagination, and, whenever orchids are mentioned, these seemingly fragile and delicate blooms, are recreated in the minds of those who know them. By far the greater part of them are natives of the riverbank jungles of Brazil and Central America where light, dampness and heat cause them to thrive in superabundant luxuriance. Although these native flowers may be exceptionally bewitching in their appearance, the florist has successfully formed a large number of hybrids which far surpass the original species in beauty.

The crossing of orchids is not only successful with species of the same genus, but related genera can also be used and even these hybrids have been found able to propagate themselves. Many hybrids have been formed between Cattleya and Laelia, although other genera are equally adapted for the production of new varieties.

As a rule such hybrids grow quite rapidly, develop many wonderful flowers, are very variable, and produce fertile seeds with great difficulty. Crosses of this character only become a possibility through the fact that the organism itself is variable, and has no definite unchangeable characteristics. All things in Nature are pliable, one form merges imperceptibly into another; she never produces the same thing twice, and the meaning of life and reproduction becomes apparent when the law of variation is more closely studied. Without variability and heredity, new properties could not be produced, and without the law of heredity, these could not have been passed on to the progeny.



Here is an interesting sample of the author's work with orchids. This photo shows seedlings six months old in a two and a half inch pot.

CHARACTERISTICS OF HYBRIDS

In every hybrid the characteristic properties of two individuals are united into one by the sexual method. When species having constant properties are crossed with each other, the resulting hybrid possesses a well defined regularity in its hereditary properties, and contains the peculiarities of both its parents. Should such a constant be lacking in the parents,—the properties of each being still variable—such a regularity in its hereditary properties will not be found.

The results obtained from the first generation are not sufficiently characteristic to give any certain conclusion as to the progeny of such crosses, certainties become a possibility only in the second generation.

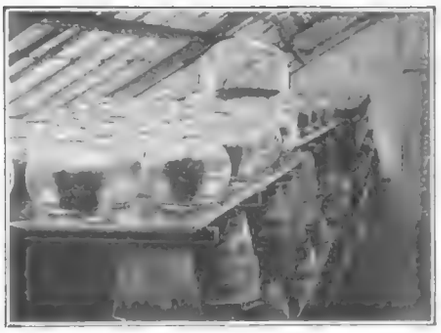
Hybrids are partially fertile and partially non-fertile and, in general, the more remote the relation of the parents the less likely are they to be crossed and the less likely will they be able to reproduce themselves. Hybrids, having but little reproductive power, can be treated so that they partially recover their regenerative ability. This is accomplished by simply propagating them vegetatively for several generations.

In the second generation a splitting up of the progeny occurs, and this in a well known percentage is known as Mendel's law. From a careful selection of this generation, the next, or third, will come true to form. For, on crossing different genera, certain well defined characteristics may combine, but these characteristics of the hybrid are not so firmly established that they can not be resolved again.

Another corner of Dr. Bade's conservatory and here we see a further development of seedlings occurring in boxes covered with glass.

Chemical glassware comes in handy for growing the young plants. Left: Orchid seedlings in a glass vessel.

The photo below shows how the anthers are removed with the tip of a pencil. The crossing of species is explained in the article at length.



One corner of the author's conservatory. The seeds are sown in flower pots which are stood in water, covered in turn with glass globes.

CROSSING SPECIES

It is a common practice to cross species of the same genera.

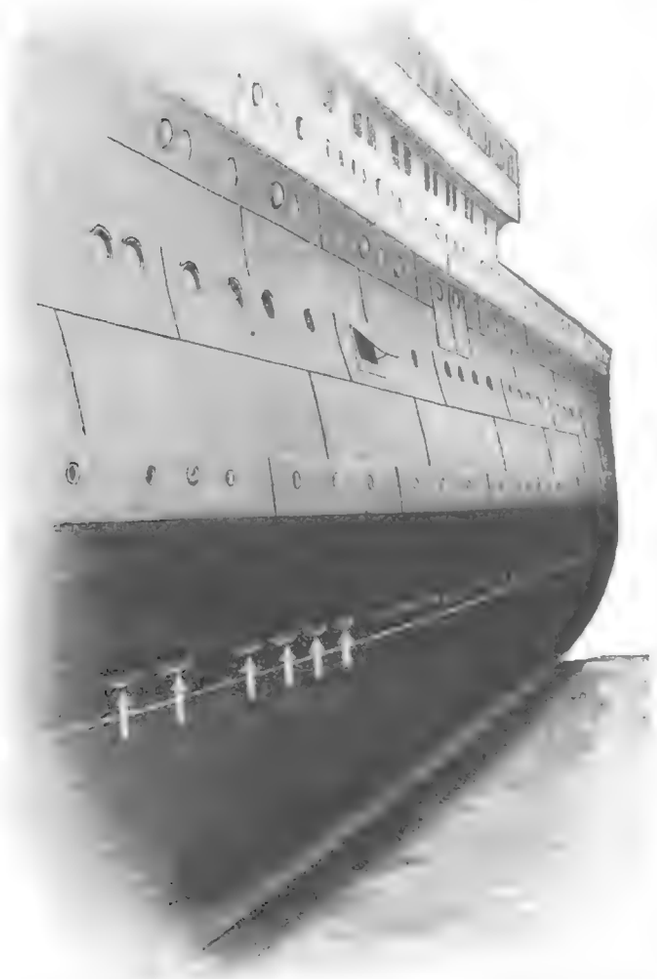
If this process is utilized for the production of new forms, the coloration of the flower is most important. The variations of the existing floral tints are always limited, to a certain extent, to the color of the main genus. Blue can be replaced by red, but if yellow is lacking, it cannot take the place of blue. On the other hand certain red colors may change to a blue, as the coloring matter, anthocyanin, which is dissolved in the cell sap, is known in a red, purple, and a blue modification. But not every red is adapted for this purpose. The yellow pigment of the flower is usually produced by chromatophores which, when xanthin is present, is yellow, and when this and carotin are present, is changed to orange. Rarer in occurrence is a yellow coloring matter dissolved in the cells as, for instance, in Antirrhinum, Verbascum, Dahlia variabilis, etc. White flowers do not contain a coloring substance but, between the glassy, transparent cells of the flower, air spaces are formed.

It is these existing colors, which may be light in one and dark in another, that the florist must take into consideration while producing new colored varieties. If two different plant species of the same or related genera possess different colored flowers, then both can, undoubtedly, be successfully crossed and the hybrids derived from the seeds may take on characteristics, which lie midway between the parents. Continued propagation can, if conditions are favorable, result in a new variety of flowers having

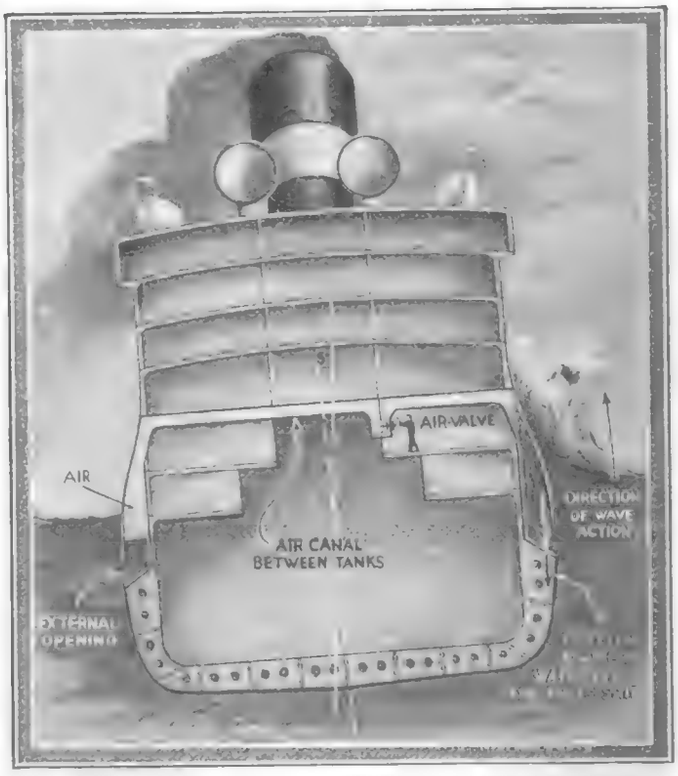
(*Continued on page 272*)

Another sample of the author's experiments in growing orchids. The seedling here shown is one and a half year's old, in a 2-inch pot.

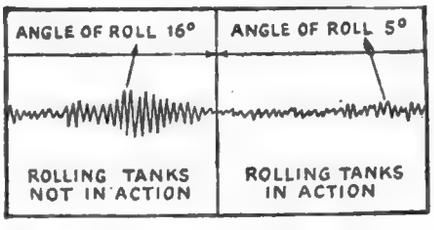
Preventing Ships From Rolling



The picture above shows the openings along the hull and below the waterline through which the water enters and escapes from the anti-rolling tanks, a new German invention, which bids fair to become popular in the design of ocean steamships. Here nature does the work.

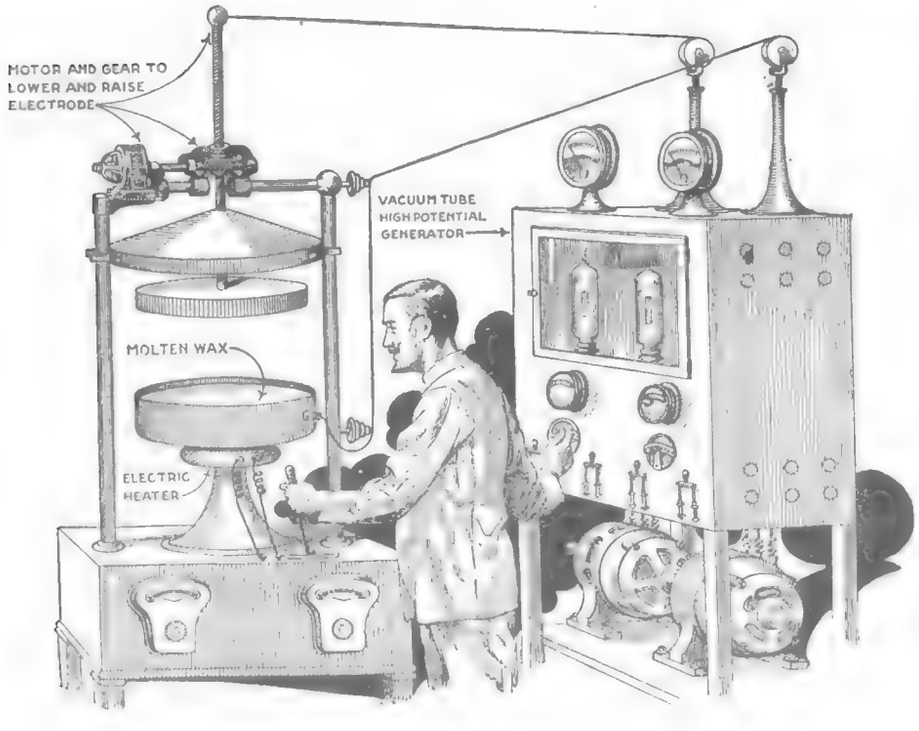


There is a chamber provided on each side of the hull and these two spaces connect by a pipe running across the ship, through a suitable reducing valve. As the ship rolls, water enters one or the other of the compartments, and the reducing valve retards the motion of the air or water, causing the water in either case to counterbalance the wave action.



The two diagrams at the left show in a vivid manner the great increase in stability of the ship when fitted with these new anti-rolling tanks. The results obtained by using a gyroscope on board the ship are also similar to the ones shown.

Permanent Electric Charges a Scientific Wonder



FOR many years we have known and used permanent steel magnets, but what would you think if a man handed you a small metal box containing a cake of wax, which he told you contained a permanent electric charge? In other words according to this idea, we shall before long be going into an electric shop and asking for a 100-volt cake of wax, or maybe they will be rated in kilowatt-hours. Thanks to the remarkable experiments of a Japanese physicist, Prof. Mototaro Eguchi, it has now become possible to impress a permanent charge of electricity into a cake of wax. Molten wax, as shown in the picture at the left, is allowed to harden by cooling in the presence of a strong electric field. The wax mixture employed by Prof. Eguchi usually contained 50 per cent. of resin, mixed with 50 per cent. of carnaüba wax. The electrostatic charge is applied to the wax by means of a metal plate lowered on to the molten wax, and also through the metal pan containing the wax. The high potential is obtained from vacuum tubes as shown in the picture herewith. As will be seen the metal pan and the metal plate lowered over the wax, constitute a high voltage condenser, and the wax mixture as it hardens, is acting as the dielectric of this condenser. One side of the wax is found to be permanently negative, and the other side permanently positive. Some of the charged electrets have lasted since 1919.

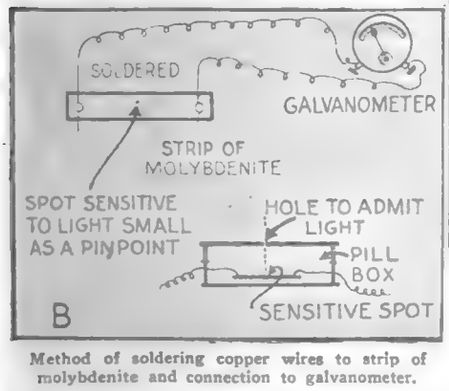
Electricity Direct from Sunlight

By S. R. WINTERS

WORKING as a hired hand, for $1.25 per day, on a dairy farm near Youngstown, Ohio, a struggling youth was obtaining a livelihood and sharing his meager funds with the demands of an education. Thirty-five years later, this same individual has achieved the revolutionary thing of transforming sunlight directly into electricity. This remarkable discovery which may prove to be one of the far-reaching achievements of science within this generation, is to be credited to Dr. William W. Coblentz, Chief of the Radiometry Section of the U. S. Bureau of Standards. Delving into all sorts of substances and studying their reaction to radiant energy from sun, moon, and stars, Dr. Coblentz has discovered a mineral that performs the incredible feat of *changing light directly into electric current.* Molybdenite is the name of this magic mineral and, unfortunately, each sample contains a spot no larger than the point of a pin that produces this marvelous result of converting light into electricity. This sensitive spot, small as it is, when exposed to the sunlight, generates enough electric current to throw the needle of an electrical measuring instrument clear off the scale.

Samples of molybdenite used by the Bureau of Standards in its experiments of transforming light into electricity, are placed in ordinary pill boxes, the piece of mineral being soldered between two fine wires. The chip of molybdenite contains a very small spot, barely larger than the point of a pin, which manifests this inexplicable phenomenon of changing light into electric current. A single pin hole is made in the pillbox, the tiny hole being opposite the magic spot on the mineral, and when exposed to the sun, sufficient electricity is generated to deflect the needle of the galvanometer.

The large picture at the right shows how electric sun power plants of tomorrow may furnish our electric current. Electricity from light-activated cells charges a storage battery; the current being drawn from the battery as required.



Method of soldering copper wires to strip of molybdenite and connection to galvanometer.

The sunlight shines through a pin-hole in the top of pill box on to sensitive spot on surface of molybdenite strip. As long as the sun shines on the molybdenite, a deflection is noted in the galvanometer. Connecting several of the strips in series yields an increased voltage.

Photo shows Dr. William W. Coblentz of the Bureau of Standards at Washington, D. C., in his laboratory and he is examining several specimens of molybdenite, the mineral which he has found to be sensitive to light. Whenever the light falls on a piece of molybdenite, an electric current is set up within it, which can be measured with a galvan[ometer] shown in the other illustratio[n]

The Third Degree of Old

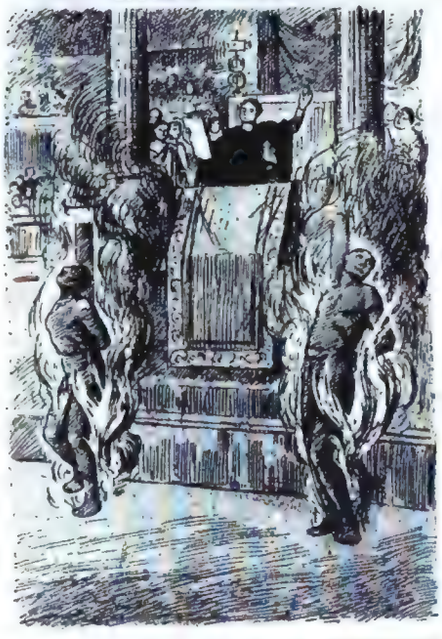
HUMAN TORTURE IN THE ROMAN ARENA

IN SPAIN

The picture speaks for itself. Each victim has a hand nailed to the upright plank behind him and they stand there in agony, while the lesson given and its moral are supposed to be dilated on by the preacher. The strange costume worn and the curious mitre-like hats are supposed to be correctly shown.

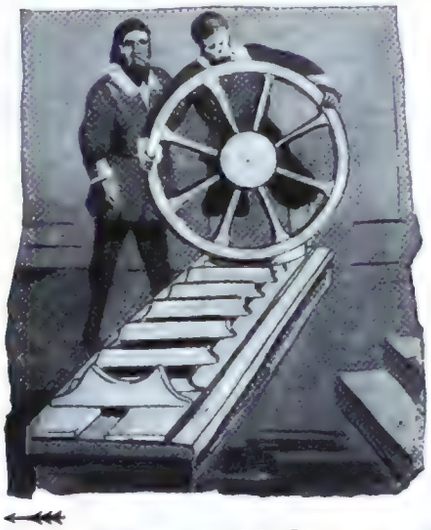
A BED OF TORTURE

On the right: The unhappy victim lies prostrate on a plank driven full of pointed nails. One of the executioners is shown tying him down and the others are working upon his shoulders apparently to see that he escapes no whit of the torture. The general impression from this old engraving is that it was an everyday occurrence.



On the left is shown one of the Roman Caesars who was said to have covered victims with melted wax and had it lighted, so as to have human torches. The engraving shows them on fire in the arena. We do not know how well authenticated the story is.

APPARATUS FOR BREAKING WITH THE WHEEL

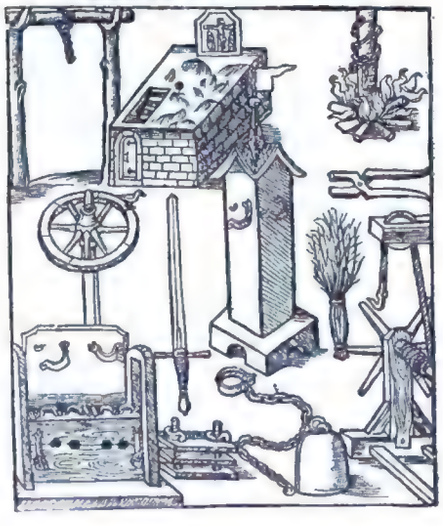


Above is shown an apparatus for breaking with the wheel. The victim placed upon the sharp series of ridges has his bones systematically broken by dropping the heavy wheels upon the victim spacing the blows by the openings between the ridges.

TORTURE BY FIRE

The victim tied to the wheel is turned round and round over the fire prolonging his torture for a period of many minutes, or even hours.

REPRODUCTION OF A CURIOUS OLD PRINT, SHOWING INSTRUMENTS OF TORTURE



To the left is a reproduction of a curious old engraving showing various instruments of torture, the uses of which our readers will now be able to appreciate after the very wonderful series of old-time illustrations which we have reproduced in these columns.

TEARING APART BY HORSES

On the right a victim is being torn apart by four horses. The old engraving well illustrates the barbarity of the torture witnessed by a number of cold-blooded spectators, some of them evidently men of high rank.

Ancient Torture Methods

PART II

By PROF. T. O'CONOR SLOANE, Ph.D., LL.D.

THE subject of torture has quite an extensive literature. It is surprising in the larger libraries to find so many books on the subject catalogued. Torture is of very ancient origin and for many centuries was regulated by exact statutes of law, varying in the different countries. Some hundreds of years ago it was a subject that was treated by law-students in their theses, and to use a colloquialism, for a period covering many centuries, it was considered "quite the thing." It was regarded as the best method of teaching the status in law of a criminal; the idea was to induce a witness to give testimony in the case of an alleged criminal, and it was used in the most curious way to induce an alleged criminal and one who was believed to be a real one, to confess his crimes. There was a very definite feeling of almost statutory force, that no one should be punished for a crime unless he acknowledged having committed it. To make him acknowledge it and to force him to confess the supposed offense, torture was applied. This seemed to satisfy the consciences of the judges—it was a sort of *"ipse dixit,"* on the alleged criminal's past.

The examination under torture is shown in this old engraving. It may be a suspected criminal from whom an acknowledgement of guilt is sought, or it may be a witness. The strange idea seems to have been that a criminal should confess before punishment, and the statements of a witness under torture were considered the very best kind of testimony.

It is told of one of the English kings that he had the thumbscrews—a well-known instrument of torture—applied to his own thumbs; as he began to feel the pain, he called out to stop it, and said that another turn of the screws would make him confess anything. It is perfectly obvious that this was the expression of the probable effect of torture. The means and method of inflicting it and the instruments used were quite varied and a certain degree of ingenuity, of what may be termed the diabolical order, were exhibited by their constructors and inventors.

Our readers will find numerous examples of the instrument of torture illustrated here. It is stated that as many as 600 different instruments have been invented for torturing and some of the most curious things are brought out. Thus one authority declares the torture could be legally inflicted only with ropes and then he describes a number of ways of doing this.

One of the English methods of torture involving death was to hang, draw and quarter. The man would be hanged until partly dead, if we may use that expression. He was then lowered to the ground and disemboweled, and the story is told of a lady holding the unhappy victim's head in her lap while he was cut open, as if that could assuage the victim's pain. But even this incident gives a viewpoint for the psychologist.

Another form of torture used in England bore the name of the Scavenger's daughter. A man named Sir Wm. Skevington revived its use in England and his name was transformed into Scavenger. It is a simple wire hoop. The victim was doubled up and trussed into it and left there in constantly increasing agony.

The stocks were used in comparatively recent times. One of the pictures shows a man with one foot in the stocks, and the foot bare and a boy tickling it. And one of the most excruciating tortures is given as bathing the feet with brine and causing a goat to lick them with his rough tongue, tickling the epidermus. It is curious to read of Frederick the Great, who mounted the throne in 1740; he was supposed to have abolished torture in that year, but treason, rebellion and some other crimes were excepted, and even Frederick himself twelve years later ordered two citizens to be tortured on suspicion of robbery.

The strappado, one of the most famous tortures, was sometimes called the Moine de Caine, which means the Monk of Caen, the latter a city of Normandy. The hands were tied behind the back as shown in the gruesome illustrations and what was called the *question ordinaire*, the ordinary question, was carried out by fixing a weight not over 125 pounds to the feet, while the victim was pulled up into the air. Drawn up in this way the torture was very great and its brutality was increased by raising the victim a certain distance and dropping him part way to the ground so as to dislocate the shoulder joints. For the extraordinary question, a weight of 250 pounds was attached and three consecutive jerks would be given.

A clue to how the victims took all this, may be found in a story of a man who said he preferred the strappado to being hanged, for he could get a surgeon to put his shoulder joints back again after the dislocation, but he said he could not get him to fix a dislocated neck if he was hung.

Titus Oates' perjured testimony sent many an innocent victim to death just before the days of the restoration in England. When the Stewarts came in again he was convicted, and it might have been well to send him out of the world by the quickest method. Instead of that, he was led behind a cart through the streets of London from the Tower to Hyde Park Corner, a distance of about two miles. The latter was the locality of the famous Tyburn, where so many victims of the savage laws of those days were executed. All the way through the streets, he was lashed upon the bare back. He was sent back to prison, allowed to rest for a day and then the flogging was repeated, but as he was unable to walk he was put upon a hurdle and dragged along the ground and beaten all the way. The number of strokes given to him were counted and they were multiplied by six because there were six lashes in the whip, and it is told that the unfortunate man received several thousand stripes. He survived all this and lived for many years after. One of our illustrations in the last issue of SCIENCE & INVENTION shows him pilloried.

The Russian knout was probably the most terrible weapon of such chastisement, short of the chain scourge. It was a whip with a single lash about ½-inch square, of leather or hide which had been soaked in water to make it harder. The executioner was trained in its use. He practised upon a pile of sand, giving vertical strokes and by practising was able to lay them close against each other, so that a succession of strokes covered the whole back, leaving it a mass of mangled flesh, and if it did not kill the person, it ruined him for life. It has even been said that the second blow might be fatal.

Maria Theresa was Empress of Austria when a document was issued in 1769, giving elaborate instructions for the administration of torture giving descriptions and illustrations of implements in use and how to employ them. The tragic death of her daughter, Marie Antoinette, followed this after a little over twenty years. In parts of Germany torture was kept up until 1831.

The pouring of cold water upon the head of its victim proved to be a very severe torture, and as late as 1858 it was inflicted with fatal results in Auburn Prison, New York.

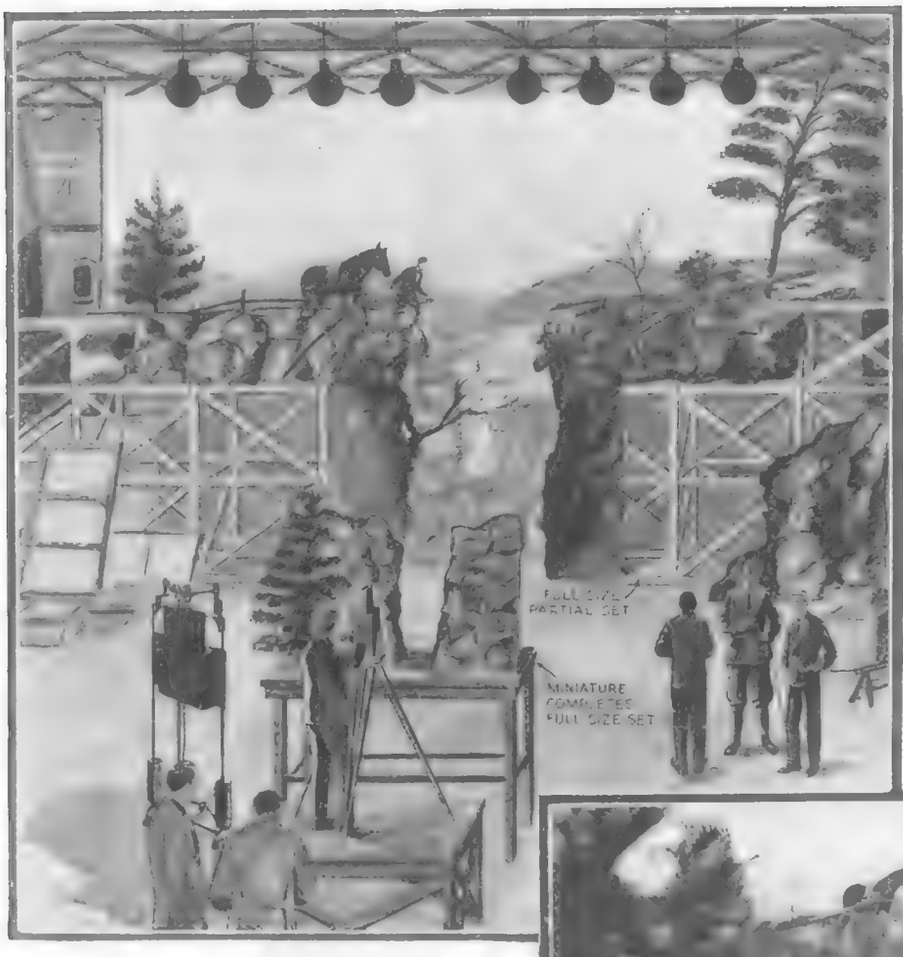
One of the cruellest things about humanity is that they seem to enjoy the infliction of suffering. We have seen it in our own country when the two young men in Chicago killed a boy trying to commit what they termed "the perfect crime." We are told that in England, in the days of the infamous Judge Jeffries, people used to go down to the hemp works where unfortunate women criminals were used to work on the hemp for ship's ropes and cables, and the visitors went there for the purpose of seeing them

(*Continued on page* 278)

Fooling the Movie-Going Public

How Unusually Life-like Results Are Obtained By Trickery

By A. P. PECK



The scene shown in the photograph below was taken in a large motion picture studio, and is illustrated at the left. The finished picture gives every indication of having been taken in the out-of-doors, but this illusion was easily accomplished by means of a miniature set and clever scene painting and lighting.

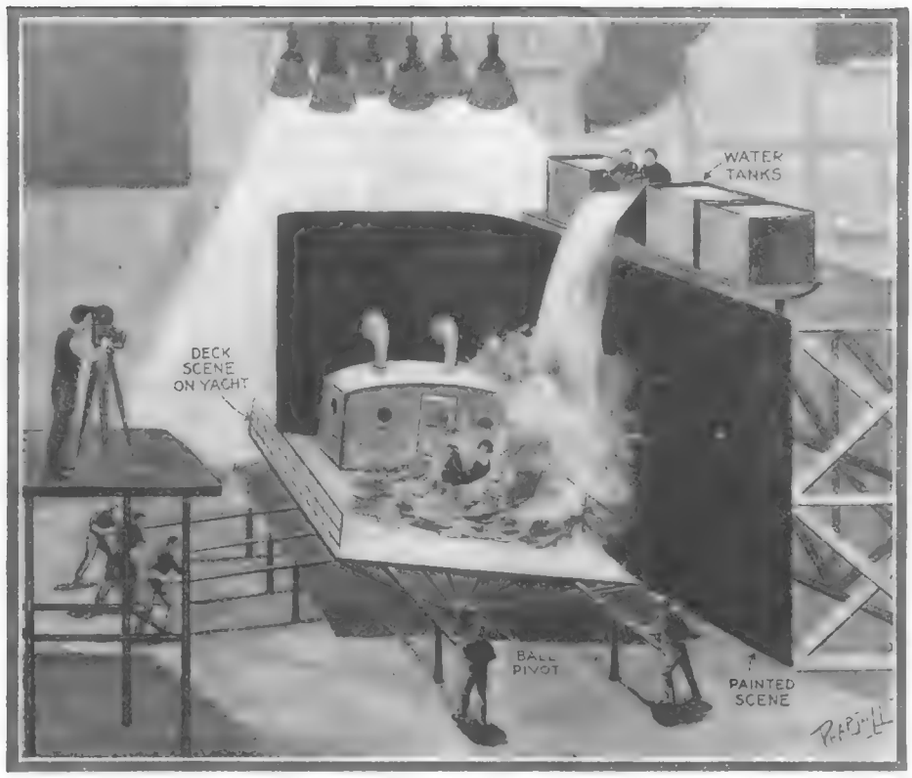
THE hero on horseback is dashing madly to the rescue of the heroine. The bridge across the ravine is broken. To go around will mean a trip of many miles and a loss of hours of time. What shall he do? He studies the situation for a moment, leaps once more upon the back of his trusty steed and heads back up the trail as though he were to take the detour. But, such is not his intention. At a distance of a few yards from the broken bridge he wheels his horse and applying quirt and spur dashes recklessly toward the yawning chasm. What can save him from death? Nothing but the sturdy muscles of his horse. Nearer and nearer the brink they approach. Gathering himself for a mighty leap, the horse launches forth into space and lands safely on the opposite side. The hero triumphantly proceeds on his way to the rescue of the heroine. And what does all this mean? It is merely a short part of the plot of a motion picture story and here is where we come in. The scene that has just been described was taken in an indoor studio! Not in an outdoor studio, not on a natural location but in an ordinary everyday studio whose only recommendation for attention is its size. Imagine a set inside a building that will be large enough to stage the above described scene. It seems almost impossible, but nevertheless this is just exactly what has been accomplished at the Long Island studio of Famous Players-Lasky.

The photographs show the hero of the above described episode examining the broken bridge. Look at the lower photograph carefully and notice how natural everything appears. Then glance at the illustration above and to the left of the page and you will see just how the scene was taken. A full size set was partially constructed and rigidly cross-braced, so as to be amply strong enough to support the weight of the horse and the actor. Canvas covered the set and it was painted to represent rocks and ground. But the set was not fully completed. Only a small part of the upper edge and the edges of the chasm were covered with this canvas and disguised after the manner of nature. If you were to walk into the studio at this time and look over this set you might wonder what in the world it could ever be used for. But wait a moment. Thirty or forty feet in front of the incomplete full size set is a very small miniature set on a platform. In front of this miniature is the camera on its usual stand. If you were to stand in the same position as the camera occupies and look toward the large size set, you would see that the miniature in the foreground would blend with the rest and give the effect of a completed set. Using miniatures in this manner for filling out partially completed settings it is possible to save quite a lot of time and money in the constructional work. However, it must not be thought that a trick photograph of this nature is taken in a few moments. Quite the contrary is the case. It is necessary to accurately line up the miniature and the full size set so that there will be no discrepancy and then to place the camera in exactly the correct position so that when the picture is taken, there will be no noticeable line of demarkation showing where the miniature ends and the partial full size set starts. Because of the fact that it is practically impossible to retouch a long series of small motion picture negatives, this accuracy becomes imperative and without it the uses of miniatures would be greatly reduced.

TAKING SHIP SCENES

Now let us review another short section of a motion picture. The scene is the deck of a ship. It is pitching and tossing violently on the waves of an angry ocean. Viewing the scene on the screen, you can almost hear the wind whistling through the rigging and feel the salt spray against your face. The heroine, braving the rough going, is admiring nature in one of her wildest moods from the deck of the yacht. Suddenly, without warning, a huge wave approaches, breaks over the rail and sweeps the girl against the side of the cabin with great force. When you see this on the screen you would almost accuse the person who told you that this scene was taken in a studio of stretching the truth to say the least. But he would not

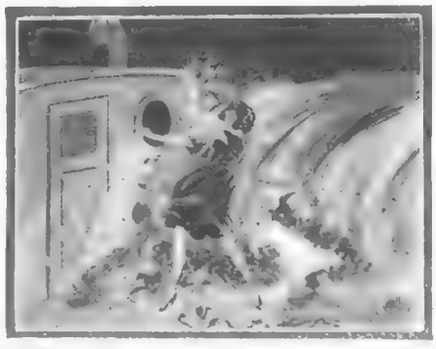
be doing anything of the kind. Scenes such as this are daily occurrences in many of the large studios and we have illustrated in connection with this article just how the work is accomplished. The way that Famous Players-Lasky set a deck scene of this nature is to construct it as illustrated. The entire scene is mounted on a ball pivot and is controlled by means of a series of long levers operated by stage-hands. By proper manipulation of these levers in a predetermined sequence it is possible to give a very realistic rolling and pitching motion to the set. Sometimes the photographs taken on a set of this nature are exposed from the deck of the simulation ship itself, but more often are taken from the side as illustrated. In this way the rolling motion is accentuated and the effect of it more readily imparted to the audience. The monster wave scene is taken by providing an imitation wave from a series of water tanks set up above the deck level and so mounted as to be easily tipped. Then at the critical moment, one of the tanks is tipped over and the effect is exactly the same as if a huge wave had come overside and swept the heroine off her feet. The background for a scene of this nature is usually painted on canvas as is illustrated.



A scene showing a huge wave coming over the side of a ship and creating havoc on the deck was taken on a studio set as shown above. The ship was rocked by means of the levers shown. The entire setting was carried on a ball pivot.

A FIGHT WITH A SHARK

We have all heard at one time or another of the pearl divers of the south seas. These intrepid adventurers dive into water infested by sharks, gather pearl oysters from the bottom and return to the surface. Often they are supposed to engage in deadly combat with the sharks and such a combat would be most interesting to see. It is almost impossible to film this with any degree of satisfaction, but by resorting once more to the studio and its trickery, it is possible to produce a motion picture that would give all the thrills of an undersea fight without any of the dangers. One of our illustrations show how this is accomplished. An expert swimmer and diver was employed for this work and was suspended in mid-air from a very fine yet strong wire. A flexible dummy shark was also suspended by wires which were controlled from above the scene. By clever manipulation of the control wires, the shark was made to attack the swimmer in a very realistic manner and since the actor was an expert in the water, he went through exactly the same motions as if he were actually swimming. The entire scene was photographed through a glass tank filled with water and in which several small fish were swimming. Thus local "atmosphere" was added. Other scenes interspersed with the fight scene were taken in a large tank and show the diver actually performing aquatic manœuvres. Such insertions of scenes actually taken under water help to sustain the illusion and to cause the audience to believe that they were actually viewing a battle between a swimmer and a ferocious shark.



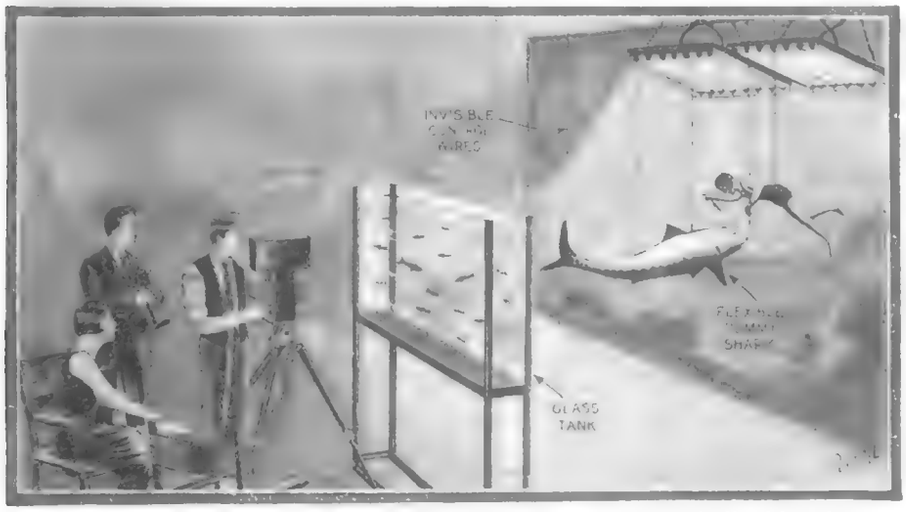
This is the way the deck scene looked in the movies when the wave came overside.

When the facts put forth above are presented in cold type it does not seem possible that the effects described could actually be produced and could actually fool the people. However, such is the cleverness of motion picture directors and the trickery of the cameraman that things can often be made to seem just what they are not. And thus the motion picture audience treads its happy way to the neighborhood theatre, is fooled and returns home just as happy as ever even though they may know that the pictures that they have been viewing disproved the old saying that the camera cannot lie.

The clever methods worked out by scene artists for the moving picture studios are numerous indeed, and strange as it might seem the problems to be solved for each photoplay production are hardly ever twice the same. Some of the best productions seen on the silver screen in the past year or two, have been made up of a combination of scenes taken aboard a full size ship, sandwiched in between close-up views of cabins, etc. In some cases particularly where ships are to be photographed in a storm scene, a miniature vessel one foot or so in length is caused to bob about in a small tank in a studio. Artificial waves are easily produced with a paddle and with water sprayed over the ship from a garden hose, acted upon by the breeze from an electric fan, a startling storm scene is enacted before the camera.

One of the unusual features of motion picture work, both in the studio as well as in the open, is the fact that colors which show up well on the regular theatre stage, do not photograph distinctly in the movies. Therefore the visitor to the movie studio will be surprised at the peculiar and insipid colors frequently used, both in painting the scenes as well as for facial "making up."

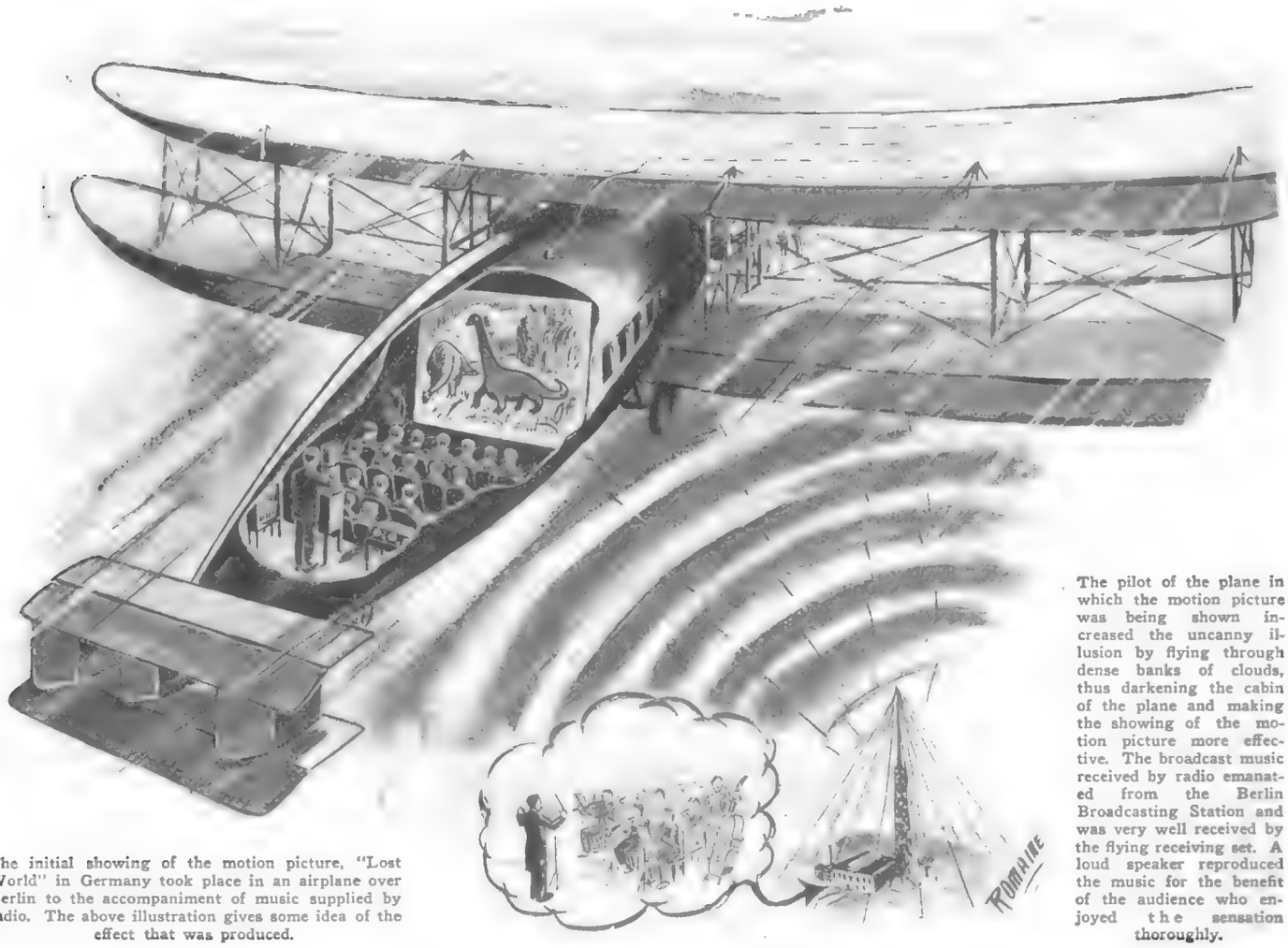
Those interested in the various tricks used in photographing startling scenes for the movies will find some very interesting reading by looking over past issues of this magazine. Spectacular and unusual scenes which have appeared in many of the leading photodramas and comedies including some of Harold Lloyd's features, are discussed and elaborately illustrated in the articles which have appeared in these past issues. One of the most stupendous photoplays ever produced, "Ben Hur", was described in the March issue in elaborate detail.



A battle to the death between a swimmer and a man-eating shark was recently filmed by using a flexible dummy shark and suspending it and the actor on thin wires. The scene was photographed through a tank of water.

"Lost World" Above Berlin

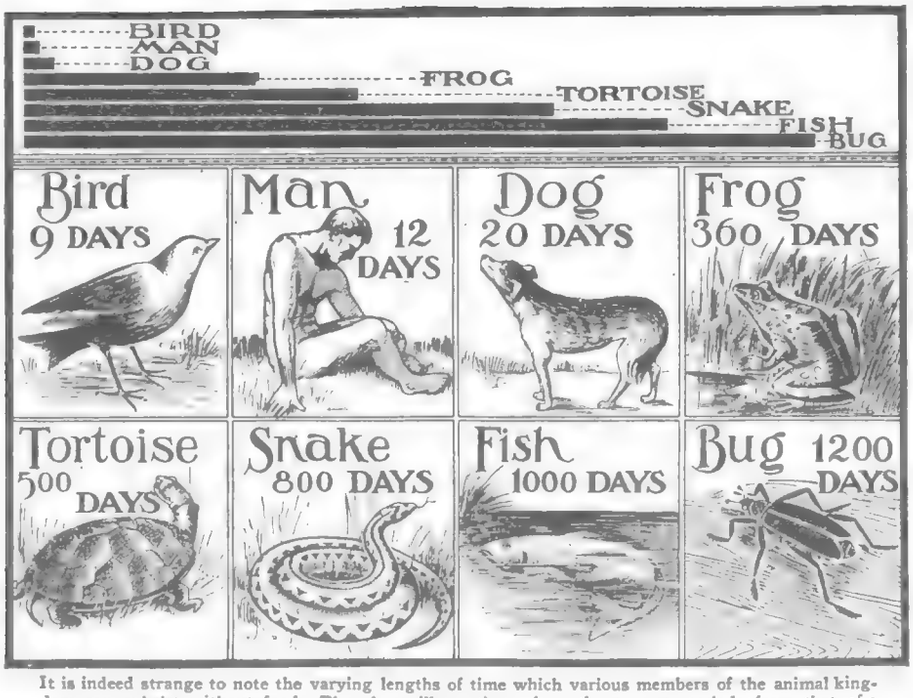
Movies and Music Aboard Airplane in Clouds



The initial showing of the motion picture, "Lost World" in Germany took place in an airplane over Berlin to the accompaniment of music supplied by radio. The above illustration gives some idea of the effect that was produced.

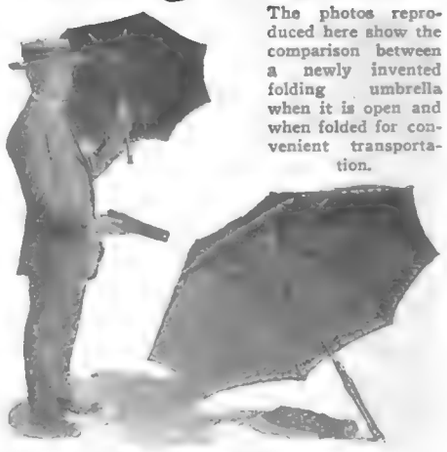
The pilot of the plane in which the motion picture was being shown increased the uncanny illusion by flying through dense banks of clouds, thus darkening the cabin of the plane and making the showing of the motion picture more effective. The broadcast music received by radio emanated from the Berlin Broadcasting Station and was very well received by the flying receiving set. A loud speaker reproduced the music for the benefit of the audience who enjoyed the sensation thoroughly.

The Starvation Limit Illustrated



It is indeed strange to note the varying lengths of time which various members of the animal kingdom can subsist without food. The above illustrations show the average periods from that of a bird, which can exist for nine days without food, to that of an ordinary insect which lives without nourishment for a period of one thousand two hundred days, nearly four years.

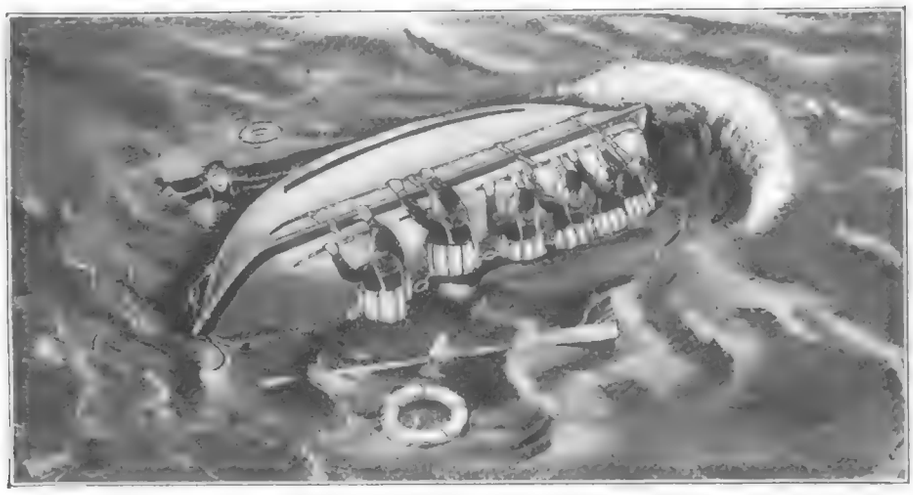
Folding Umbrella



The photos reproduced here show the comparison between a newly invented folding umbrella when it is open and when folded for convenient transportation.

A FOLDING umbrella that will fit into a coat pocket yet when opened is as large as a standard umbrella, has recently been invented by Frank J. Pugel. The umbrella is strong and very durable, yet is light in weight. The steel tube handle telescopes and a few turns of it engage concealed screws which automatically close the umbrella. The outer half of the ribs folds upward and inward against the lower half which in turn folds downward and inward. When the handle is unscrewed and extended the ribs and the covering are automatically opened and held rigidly in place.

Invertible Life Boat

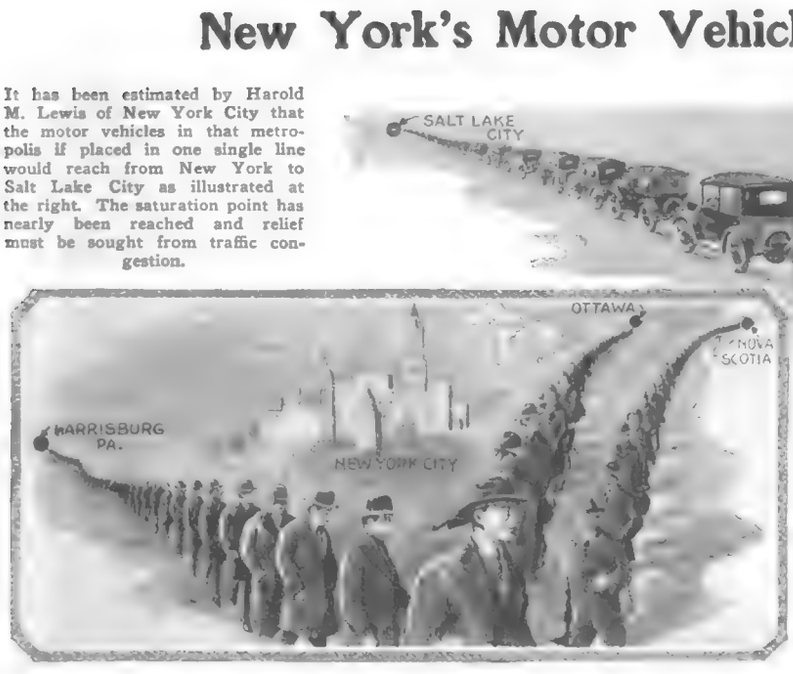


If because of high seas, this new life boat should overturn, the passengers cling to the hand rail on the keel and by rocking backward and forward can soon turn the boat over to its normal position, and climb back in and bail out the water.

Above is shown the inventor of the invertible life boat with a small scale model of the device showing the special keel.

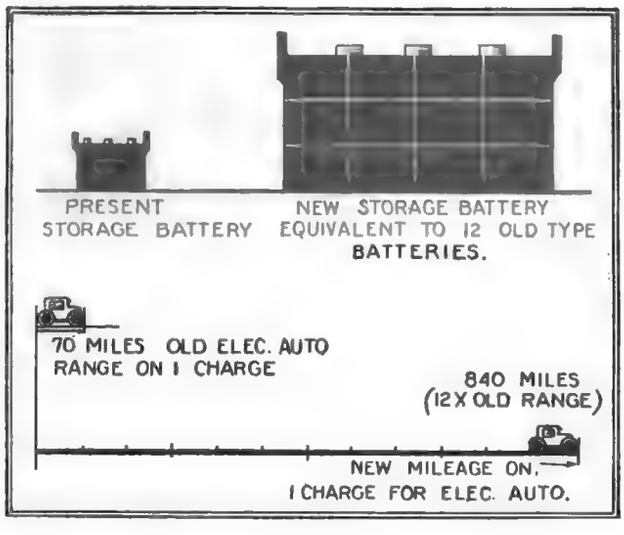
New York's Motor Vehicles

It has been estimated by Harold M. Lewis of New York City that the motor vehicles in that metropolis if placed in one single line would reach from New York to Salt Lake City as illustrated at the right. The saturation point has nearly been reached and relief must be sought from traffic congestion.



If all of the passengers carried by motor vehicles into New York City from the north were placed in a line they would reach from Ottawa to New York. Those entering by the same way on the East would extend to 15 miles beyond Halifax, Nova Scotia. From the west, the incoming passengers would reach to 15 miles beyond Harrisburg, Penna. All of these facts are graphically shown in our illustration at the left.

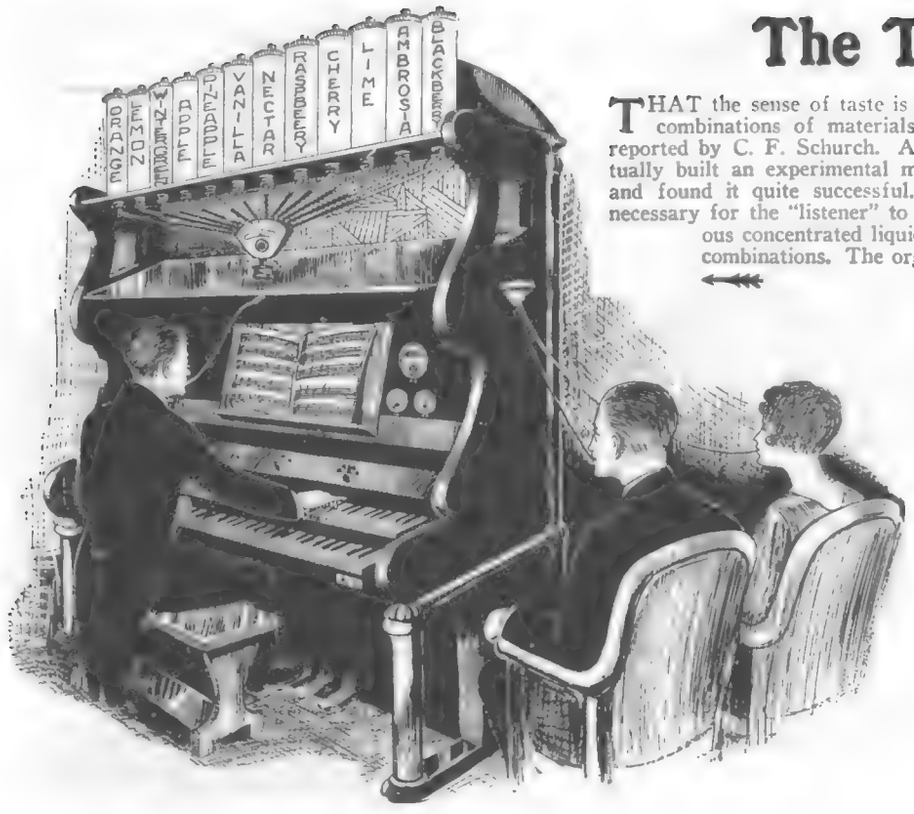
New Highly Efficient Storage Battery Promised


PRESENT STORAGE BATTERY
NEW STORAGE BATTERY EQUIVALENT TO 12 OLD TYPE BATTERIES.
70 MILES OLD ELEC. AUTO RANGE ON 1 CHARGE
840 MILES (12 X OLD RANGE)
NEW MILEAGE ON 1 CHARGE FOR ELEC. AUTO.

IF the claims of a young Viennese engineer Gunther Polcich are verified after practical use, we may soon expect a revolution in low-voltage, high-amperage electrical work, such as up to the present time has been and is being accomplished by means of large storage battery installations. Polcich claims to have discovered a new method of battery construction whereby it is possible to make up a storage battery equal in energy to that of a standard battery such as is in use today, yet which will weigh only 1/12th as much. Such a battery would be a great boon to electrically driven automobiles which with ordinary storage batteries have a cruising range of only 70 miles on one charge of the battery. With the new method of constructing batteries, the same size and weight of automobiles could travel 840 miles on a single charge. These batteries are not as yet available as they are in the experimental stage, but when they are brought out for general use, they will undoubtedly greatly increase the number of electrically operated automobiles in use.

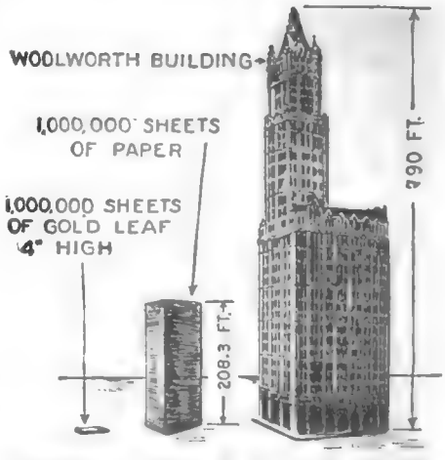
Another claim made by Polcich is that he has discovered what he terms a "primary element" and which is capable of producing electricity directly without the use of a charging source, as is required by ordinary storage batteries. The use of this element would do away to a great extent with the use of mechanically generated electricity. Thus by a chemical means it may soon be possible to generate an electrical current at a minimum expense, and in a smaller space than with any other generating and so-called storage system known today.

The Taste Organ



THAT the sense of taste is responsive to harmonies produced by the proper combinations of materials has been determined by a French scholar, as reported by C. F. Schurch. After developing the theory, this investigator actually built an experimental model of what might be termed a "taste organ" and found it quite successful. In order to enjoy the taste harmonies, it is necessary for the "listener" to hold a small tube in his mouth so that the various concentrated liquids can be injected either singly or in the correct combinations. The organ could be made up to be operated in the manner shown at the left and this illustration is our artist's conception of a completed taste-organ. Consideration of this subject is quite as interesting indeed as that of the "smell-organ", described several years ago in the pages of this magazine. It is problematical if satisfactory jazz effects could be produced by this instrument, and how about the Charleston?

Gold Leaf



Gold, most malleable of all metals, can be beaten into sheets 1/250,000th of an inch thick. A comparison between one million sheets of this gold leaf and the same number of sheets of paper of average thickness and the height of the Woolworth Building is shown above.

Safety Barrels for Waste

Keeping cotton waste and oily rags of an inflammable nature in steel barrels reduces the fire hazard, shown by the photo at the left. The fire has gained great headway in the wooden barrel but has been slowed up and confined by the steel barrel. *Photo courtesy Sheet Steel Trade Extension Committee.*

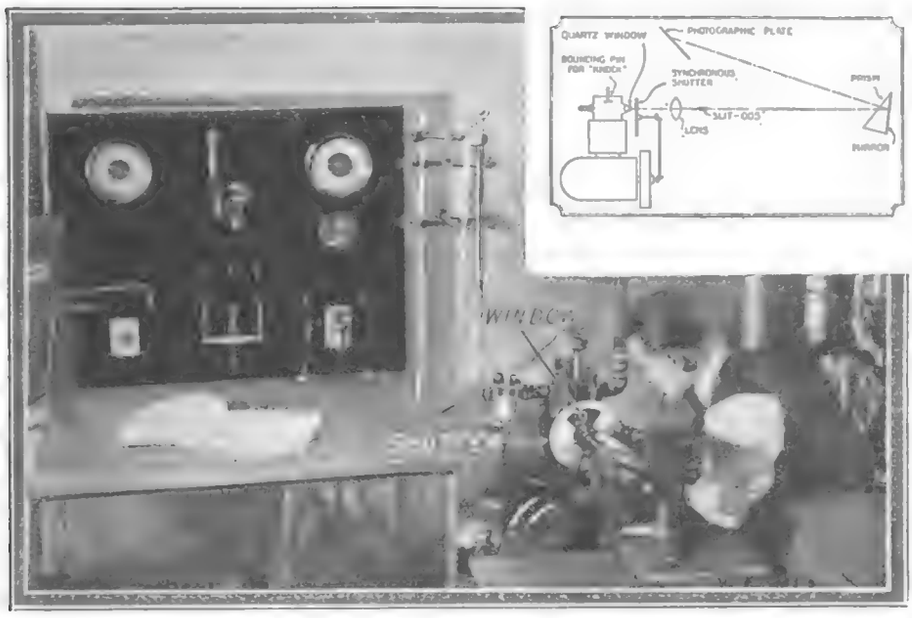
That every match is a potential fire is a fact that cannot be denied and it is certainly well worth while to do everything in your power to prevent fires. The use of sheet steel barrels for containing inflammable waste material is a great step toward fire prevention and the efficiency of such barrels as compared with wooden barrels is graphically illustrated above. The flames in the wooden barrel tend to spread while those in the sheet steel container are confined. The metal barrel operates to cut off the air supply

A Contrast In Ovens

In the farming sections of Quebec, Canada, bread is not baked in the house in the summer time but in large open air ovens constructed of rocks and clay and covered with a protecting roof as illustrated below. Compare this primitive kitchen with the one at the right. Which would you rather use?

The strictly up to the minute housewife has an electrical kitchen such as that shown above where all modern time- and labor-saving devices aid her in housekeeping. The motor-driven machine shown in operation performs numerous operations ranging from the slicing of potatoes to the rotation of an ice cream freezer. Notice the convenience and accessibility of all of the utensils.

Finding the Best No-Knock Fuel

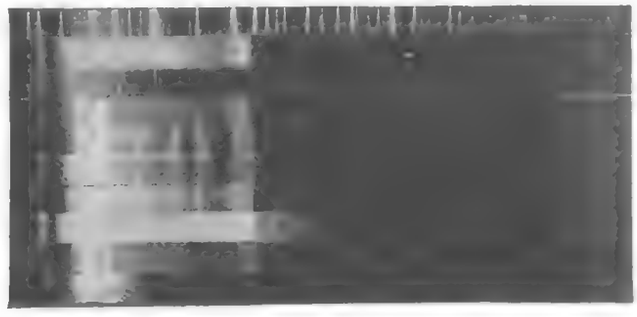


IN the past few years there has been a tremendous interest aroused in the automobile world by the development of several fuels which would eliminate knocking in the engine, due to the manner in which the fuel exploded in the cylinder. Tetra-ethyl-lead gasoline did the work admirably, but at present it is out of favor, due to its suspected poisonous characteristics. As pointed out in a communication to the Editor from Prof. George L. Clark of the Massachusetts Institute of Technology, where tests on various no-knock fuels have been made with the apparatus illustrated at the left, there are many brands of commercial gasoline which do not contain tetra-ethyl-lead and yet have non-knocking properties. Benzene and fuel mixtures containing benzene are known to be excellent in this respect.

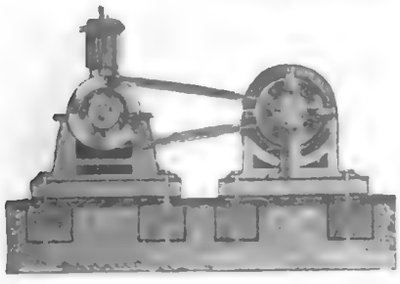
In the drawing and photograph to the left, the test engine is shown as well as the disposition of the photographic plate and the *bouncing pin* for determining the amount of knock in each fuel. The engine cylinder is fitted with a ½-inch thick fused quartz window. A synchronous shutter is utilized for comparing the reaction at the four quarters of a stroke. The spectra are obtained with a quartz prism spectrograph.

THE assembled single cylinder gasoline engine shown above operates a dynamo which can be used to regulate the load on the engine. The spectrogram shown at the right is interesting as it shows that there are other valuable no-knock fuels besides that containing tetra-ethyl-lead. The amount of detonation is quantitatively ascertained by the bouncing pin, mounted on top of the cylinder. The pin closes a circuit when it bounces as the result of a knock which electrolyzes water containing sulphuric acid and the gases formed are a measure of the knock. The spectrum obtained at knocking runs down into the ultra-violet. The weaker the knock the shorter the spectrum.

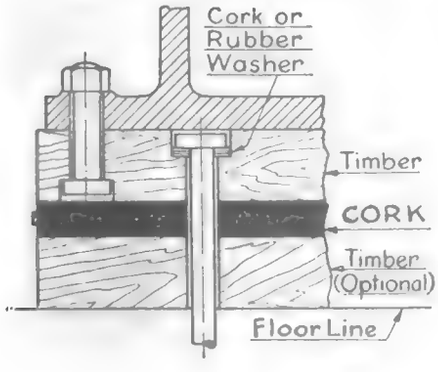
MERCURY ARC
GAS+BUTYL NITRITE
GAS+LEAD TETRA ETHYL
SOCONY GASOLINE
GULF "NO NOX"
GULF STRAIGHT
CALIFORNIA NAPHTHA
PENNA. NAPHTHA
ALCOHOL
BENZENE



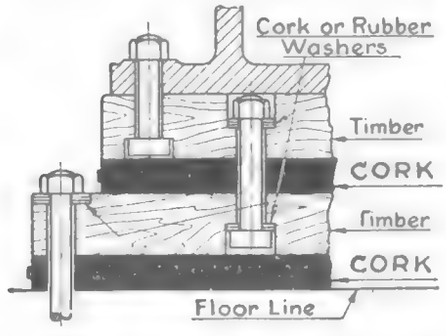
Cork Kills Vibration



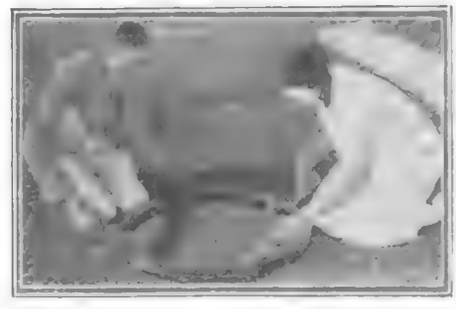
In many installations of machinery of various kinds, there is a great deal of unnecessary vibration which, besides causing a lot of undesirable noise, invariably causes a loss in efficiency and steadiness of speed. In the picture above as well as below and at right, the use of a new cork material for machine installations is shown by the black lines.



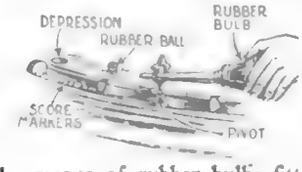
IT has been ascertained that felt, rubber, sand, springs and pulverized cork are not the proper mediums to use in eliminating vibration from machinery. The natural cork has been found very satisfactory, however, when properly treated, and this is the material used in the new vibration-proof substance here illustrated in diagram and photo. When properly treated, it has been found that the natural cork is quite indestructible, impervious to water and acids, and possesses such high resilience that it is considered the best isolator for all kinds of machinery. This new vibration eliminator is composed of strips of cork, carefully cut to size and bound together with an iron frame, which is not quite as thick vertically as the cork. The cork plates are then placed in a press and subjected to a horizontal pressure. The cork plates are then treated by a secret process.



Puff Billiards



IN the photo above we see Bebe Daniels and Malcolm St. Clair playing the latest scientific game known as "puff billiards." This game has already gained many followers and it can be played in or out-of-doors, and either two or four persons may play the game. Spaced about the center board are several depressions in which the rubber billiard balls catch, when you are lucky. The balls are shot about the game



board by means of rubber bulbs fitted with suitable nozzles. The game board is fitted with several sets of score markers, as the accompanying sketch shows, and all in all a merry time is promised the players.

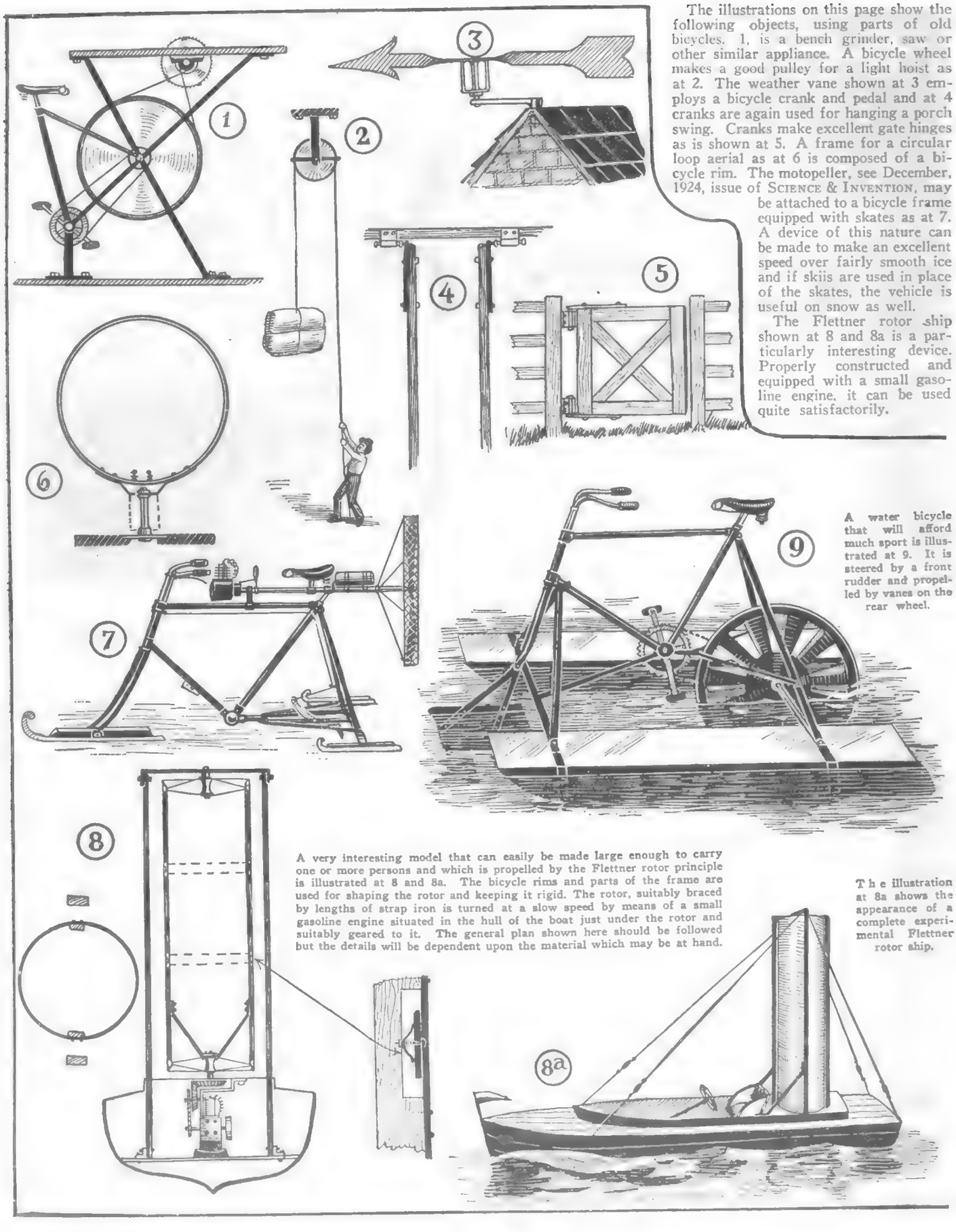
Bicycles That Are No Longer Serviceable for Their Original Purposes Can Be Used In Many Other Ways As Shown and Described On These Pages

New and Unusual Parts of

By P. C. VAN

The illustrations on this page show the following objects, using parts of old bicycles. 1, is a bench grinder, saw or other similar appliance. A bicycle wheel makes a good pulley for a light hoist as at 2. The weather vane shown at 3 employs a bicycle crank and pedal and at 4 cranks are again used for hanging a porch swing. Cranks make excellent gate hinges as is shown at 5. A frame for a circular loop aerial as at 6 is composed of a bicycle rim. The motopeller, see December, 1924, issue of SCIENCE & INVENTION, may be attached to a bicycle frame equipped with skates as at 7. A device of this nature can be made to make an excellent speed over fairly smooth ice and if skiis are used in place of the skates, the vehicle is useful on snow as well.

The Flettner rotor ship shown at 8 and 8a is a particularly interesting device. Properly constructed and equipped with a small gasoline engine, it can be used quite satisfactorily.



A water bicycle that will afford much sport is illustrated at 9. It is steered by a front rudder and propelled by vanes on the rear wheel.

A very interesting model that can easily be made large enough to carry one or more persons and which is propelled by the Flettner rotor principle is illustrated at 8 and 8a. The bicycle rims and parts of the frame are used for shaping the rotor and keeping it rigid. The rotor, suitably braced by lengths of strap iron is turned at a slow speed by means of a small gasoline engine situated in the hull of the boat just under the rotor and suitably geared to it. The general plan shown here should be followed but the details will be dependent upon the material which may be at hand.

The illustration at 8a shows the appearance of a complete experimental Flettner rotor ship.

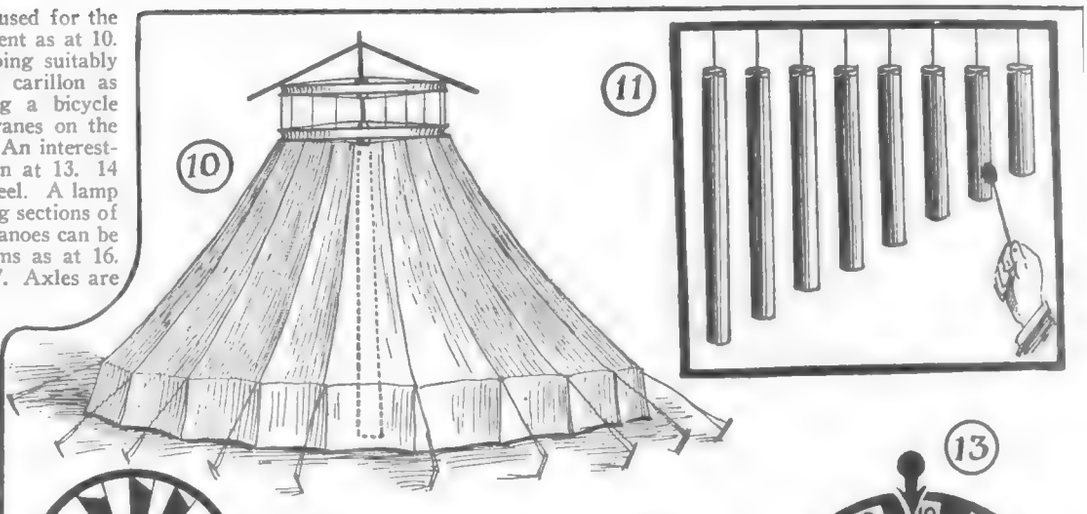
Uses For The Old Bicycles

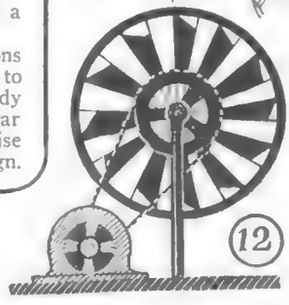
Have You An Old Bicycle Its Parts Can Be Used In Th Construction Of Any One O The Twenty-four Devices Tha Are Illustrated On These Page

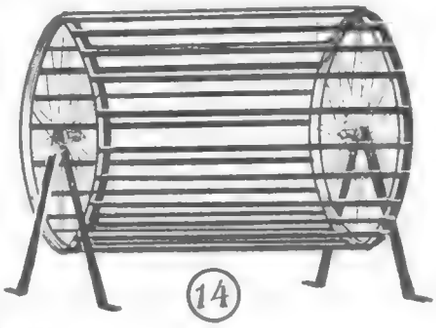
PETEGEM

Two bicycle wheels can be used for the ventilating top of a circular tent as at 10. Lengths of bicycle frame tubing suitably suspended make an excellent carillon as as shown at 11. By mounting a bicycle wheel as at 12 and placing vanes on the spokes, a wind mill is made. An interesting roulette wheel is shown at 13. 14 shows a film drying rack or reel. A lamp stand, 15, can be made by using sections of wooden bicycle rims. Light canoes can be molded into shape around rims as at 16. A boat rudder is shown at 17. Axles are made into tools as at 18 and a saddle is used as a portable seat as at 19. A door latch is made from a crank as at 20; an automobile starting crank as at 21; a table of bicycle rims as at 22; an antenna spreader of a rim is shown in 23 and a coat hanger is at 24.

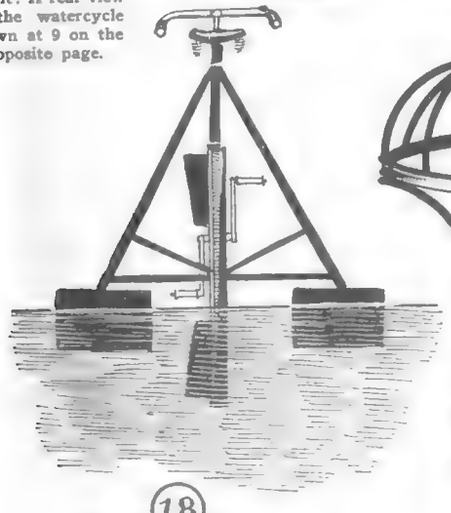
All of the illustrations show sufficient details to enable anyone at all handy with tools to make similar devices and to improvise others of his own design.

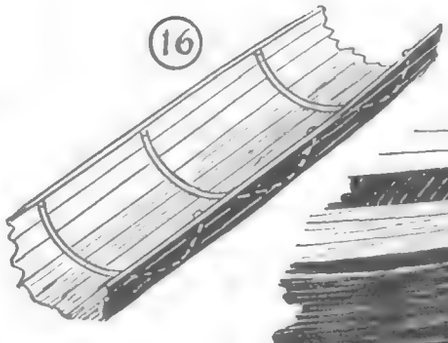


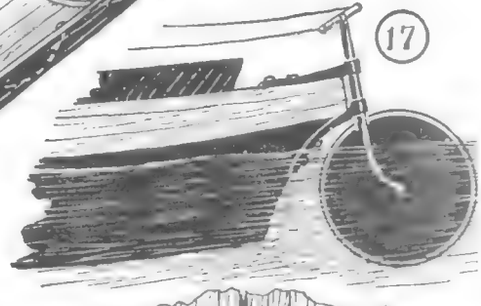


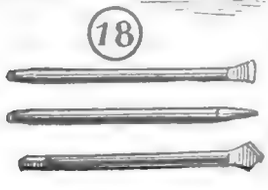


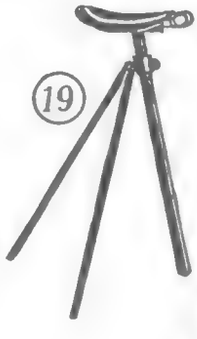
Right: A rear view of the watercycle shown at 9 on the opposite page.

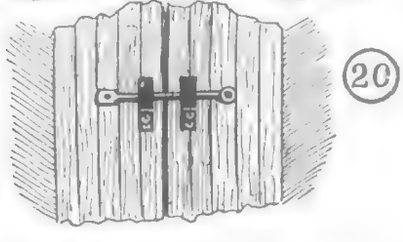


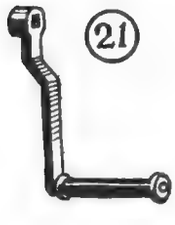


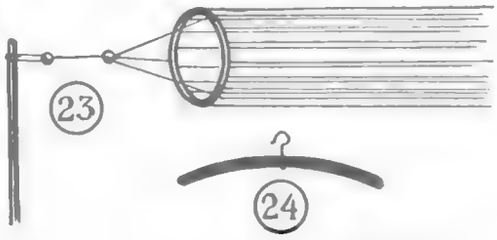






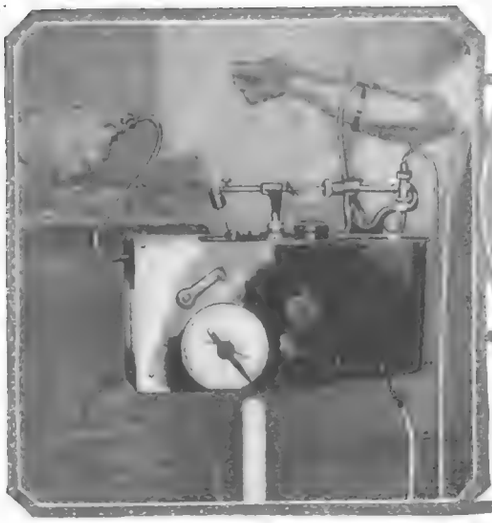




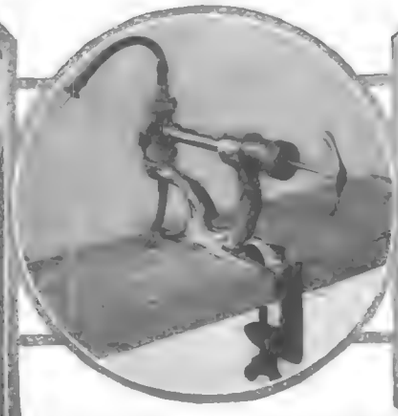


Transfusing Blood Electrically

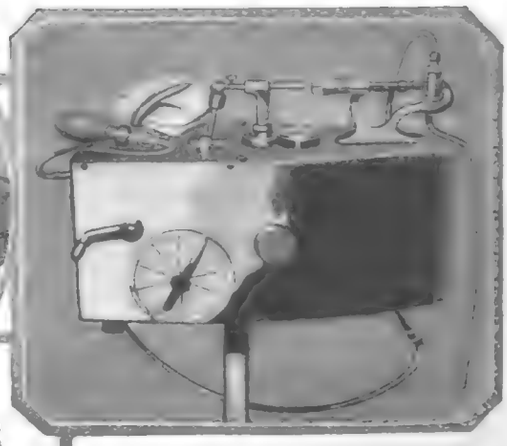
By J. W. VON STEIN



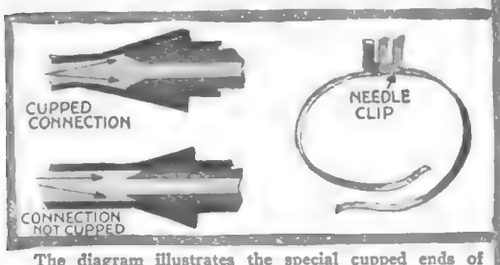
The above photograph shows the new method of blood transfusion which differs from the old inasmuch as it uses electrically driven apparatus instead of the usual forms of hand pump. The apparatus was developed by Dr. Angelo Soresi, Professor of the Principles of Surgery at Flower Hospital, New York City. The tube here shown leads from the arm of the donor or the individual from whom the blood is taken. Another tube goes to the recipient.



This photo shows the blood transfusion unit detached from the electrical apparatus and ready for use as a hand operative unit, to use where current is unavailable.



The blood transfusion unit consists chiefly of a blood controller chamber and syringe actuated by a pump driven by an electric motor. A dial and hand are arranged on the mechanism and are set for the automatic regulation of the number of strokes desired. This permits a predetermined amount of blood to be transferred and the machine will automatically stop when that amount has been delivered by the pump. The speed of the stroke may be changed while the machine is in operation. The rubber bulb on the top of the machine is for the compression band.



The diagram illustrates the special cupped ends of all connections to prevent possibility of blood clotting due to sharp projections. Bracelet holds needles.

The accessory shown in the photograph above is used in conjunction with the electrical blood transfusion apparatus and simplifies greatly the processes of local, infiltration or regional anaesthesia. It is connected to the recipient's terminal of the blood flow controller while the donor's terminal is connected with an anaesthesia tank. The anaesthetic is drawn from the tank and forced through the six needles which are to be attached to the end connections shown.

This illustration shows the schematic view of the blood flow controller, the valves in position as they would be when the blood is being drawn into the pump from the donor. The ring on the upper plug prevents the valves being inserted upside down. The balls are seated in the valves by gravity.

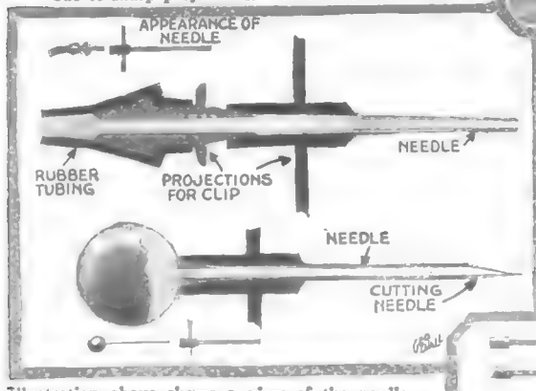
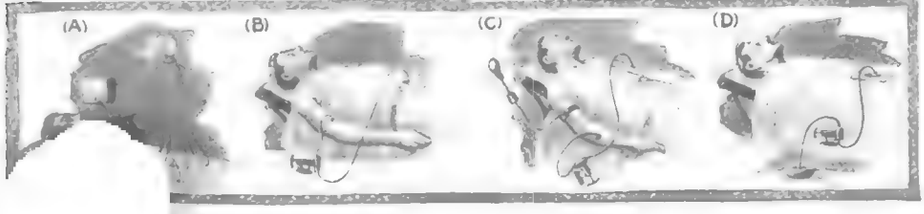


Illustration above shows a view of the needle holder with the two pins or projections for inserting it in the bracelet on the arms of the donor or recipient. To permit the needle being inserted into a vein the cutter is first pushed through the needle. After this cutting needle is withdrawn and rubber tube substituted.

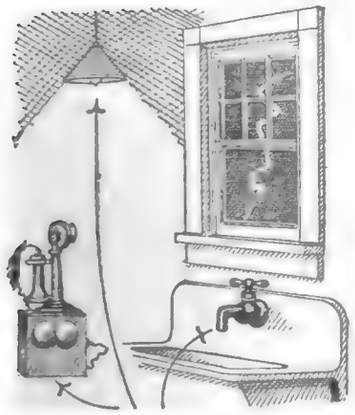
The illustration at the left shows the comparative length of the old and new type of needles. The latter can obviously reach a larger area without reinsertion. The construction of the syringe portion of the transfusion unit is also given. The spiral spring renders action of syringe more gentle. Below and to the left, A indicates the method of producing regional anaesthesia with the apparatus illustrated at the center of the page. B shows the system of effecting auto-transfusion, when the body of an exsanguinous patient has been opened and a blood vessel has been torn or cut. The body needs blood which is routed from the arm to the body. C shows the method of treating cases of hemophilia. The two needles are inserted in the same individual and the blood is taken from the circulatory system for a few seconds and then re-injected. This lowers coagulation time. Pus may be removed as indicated at D.



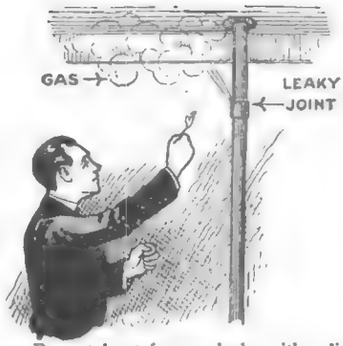
A Dozen Daily Dangers

Everyday Dangers That Can Be Easily Avoided By Exercising Judgment

By L. B. ROBBINS



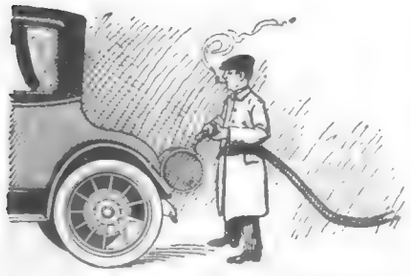
During thunder storms, it is not advisable to touch the metallic parts of telephones, lighting fixtures and plumbing appurtenances. A severe shock may possibly result if such is done.



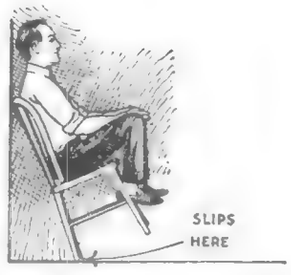
Do not hunt for gas leaks with a lighted match. An explosion is very likely to take place and to result in injury.

Do you dive before you look? Looking first may save a broken neck.

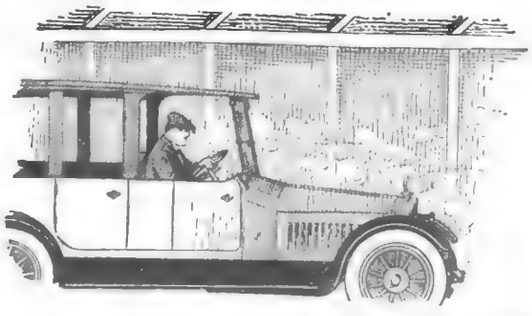
When bathing in a strange place, ascertain the depth of the water before diving. Never go swimming immediately after a heavy meal.



It is obvious that gasoline should not be handled while you are smoking, but this is often done with fatal consequences.



The result of sitting in a chair as above, may be a fractured skull or injured back if the chair slips, and such is very likely to happen.



No type of internal combustion motor should be allowed to run in a closed space as the exhaust gases are deadly. This particularly applies to small garages. Open doors when motor is being adjusted.

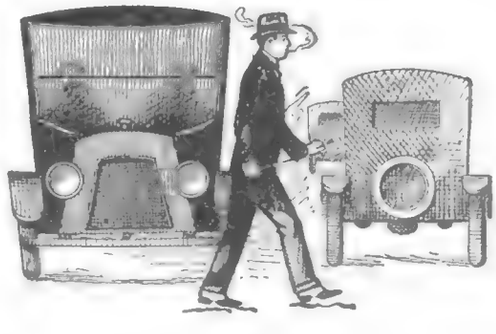
If you must board a train or trolley car while it is moving, always do so through the rear door. When trying to get on at the front door, a slip may throw you under the wheels.

When using a sharp knife, never cut toward yourself as above. If the knife should slip, there is great danger of inflicting a severe cut or doing other damage.

Washing windows in the position shown above is dangerous as a slight dizziness might cause a fall. Wash the windows from the inside by pulling the sashes up or down.

If the fire refuses to burn, do not throw kerosene upon it. An explosion will be the rule rather than the exception in this case.

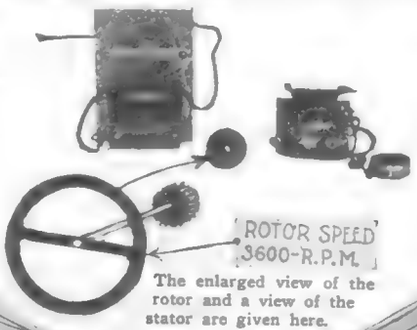
Before examining any kind of a gun, look in the breech to be sure that it is not loaded. Then the illustrated action is safe.



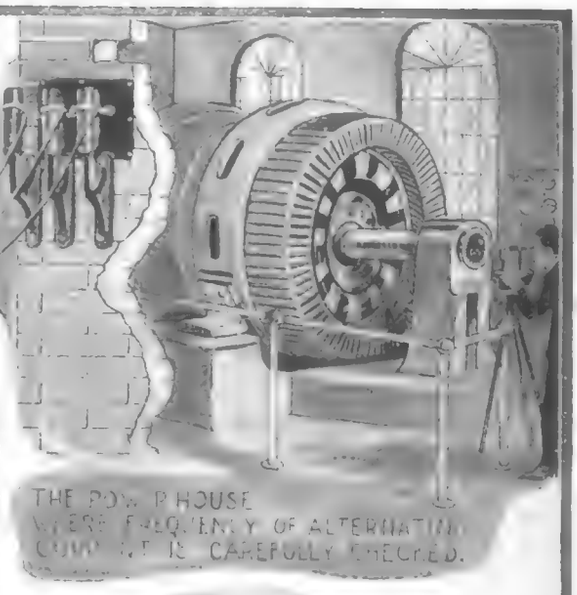
"Jay" walking is a dangerous yet common habit. Do not indulge in it, but wait for traffic to stop to allow you t

Electric Clock Can't Lose Time

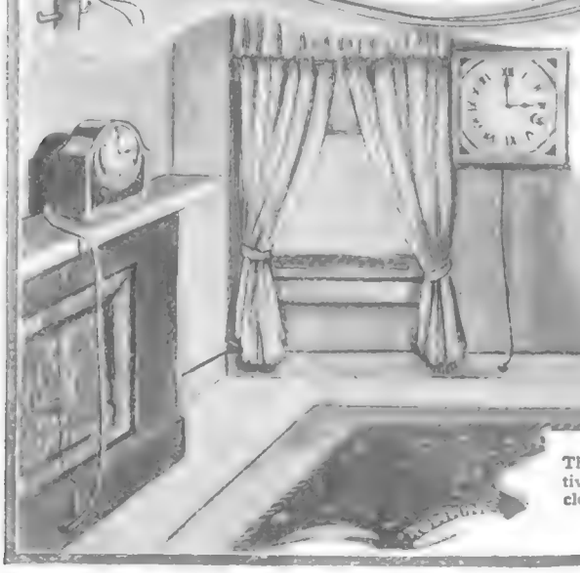
The photo at the right shows a rear view of the new alternating current electric clock.

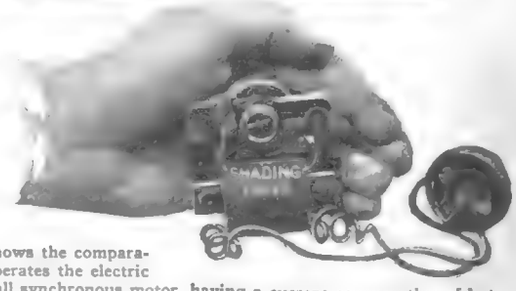


The enlarged view of the rotor and a view of the stator are given here.



The frequency of current iscarefully maintained at the power house, and because this frequency is so accurately checked the electric clock is always correct.

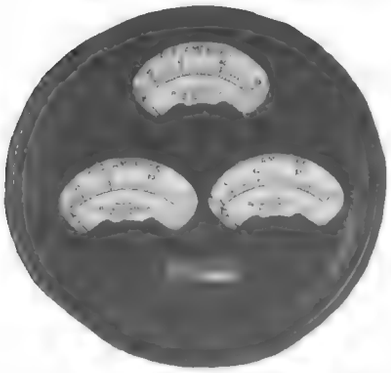




The photograph at the right shows the comparative size of the motor which operates the electric clock. This is really a very small synchronous motor, having a current consumption of but two watts..

ONE of the latest devices to make its way to the American market is the Telechron Clock. This is an electrical clock operated from any A. C. circuit. One need merely plug the cord leading to the clock into the lamp socket and set the clock once, and it will continue to run as long as it has a supply of current and will keep absolutely accurate time. Should the current at the power-house be cut off for some unknown reason, a small red disc drops into view and notifies the user of the clock that the time is no longer accurate and that the clock should be reset. The motor consists of a small two-watt stator provided with shading coils and the rotor is illustrated in the upper left hand corner of this page. The frequency of the current must be carefully checked at the central station, because of its use in operating motors in weaving plants. *Photos courtesy Electime Company.*

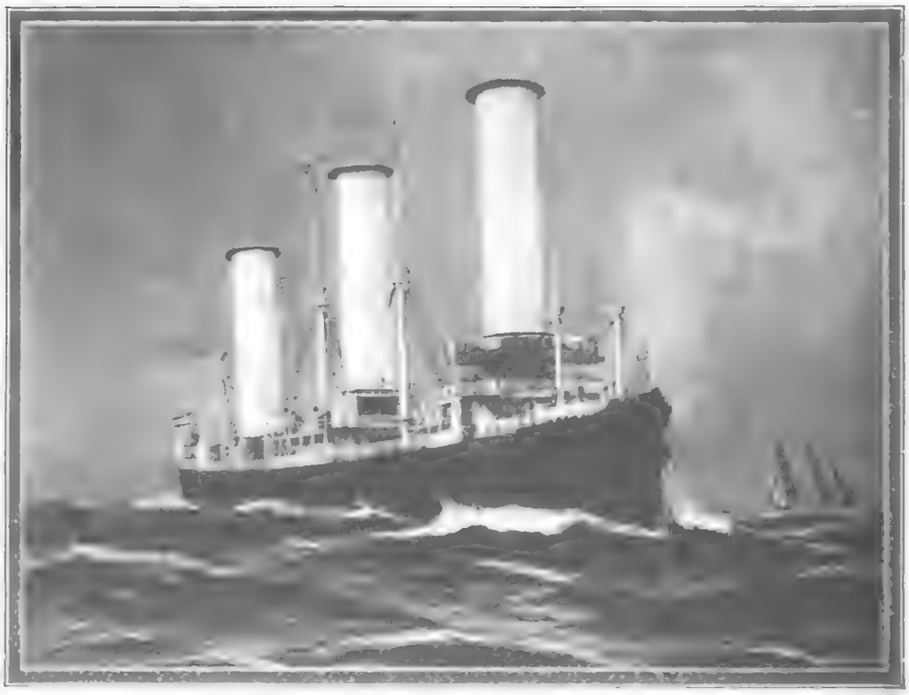
Triplex Ammeters



With the meter illustrated above it is possible to take readings in three different phases simultaneously as contrasted with the usual scheme of having one ammeter and switching it from one transformer secondary to another by means of the conventional jack. Three-phase circuits may thus be more evenly balanced, thereby tending to prevent uneven loading.

Photo courtesy Roller-Smith.

Giant Rotorship



The Barbara-Barbara, the latest and greatest rotorship just launched, is a 3000-ton vessel with a 1000-H. P. engine. Through the propellor this engine will give her a speed of 10 knots without the rotors. In a fair breeze her three rotors, requiring 40 H. P. each to drive her, will give the vessel a speed of 11½ to 12 knots. Obviously, the saving in fuel is very great.

The photograph above gives us a representation of what the Barbara-Barbara, Anton Flettner's new Rotorship will look like on the high seas. Spinning the rotors enhances the effect of the wind on the cylinders, in accordance with the well-known Magnus effect.

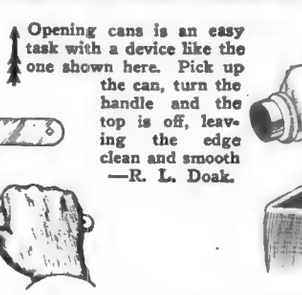
New Devices of the Month

On this page we are showing a group of the newest devices which can be employed around the home and in the office, as well as in the field of sports. The addresses of the manufacturers of these devices may be obtained by writing to this publication.

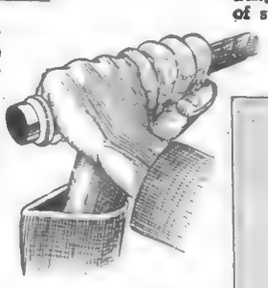
The bowl above combines all the advantages of a high chair, a rocking horse, a play pen and a walker, without the drawbacks of these devices. The chair is adjustable and arranged on a pivot enabling the baby to turn, but making it impossible for him to tip over. The bowl may be locked when the baby is to be fed and the feeding tray may be attached.—R. L. Doak.

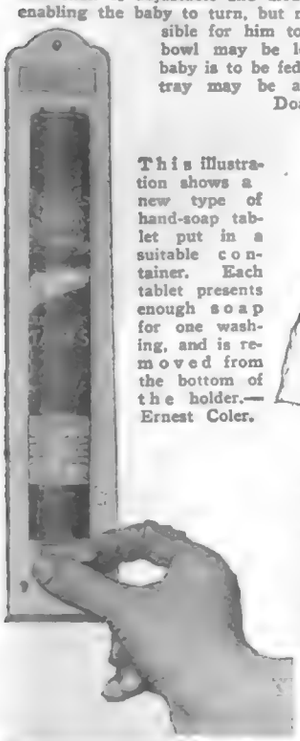
Turning the crank operates the can opener shown.

You can save yourself a fright and make baby's bath safe by putting this support into the bathtub. The support consists of a metal frame on which a canvas hammock is supported. It hangs from the edge of baby's bathtub by means of suitable clips and the height may be adjusted at both ends so that the child's head may be kept out of water regardless of how she may slide down into the tub.

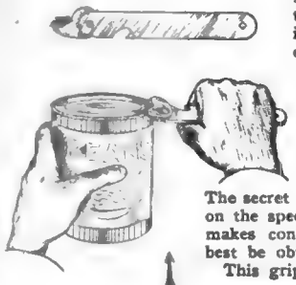


Opening cans is an easy task with a device like the one shown here. Pick up the can, turn the handle and the top is off, leaving the edge clean and smooth —R. L. Doak.

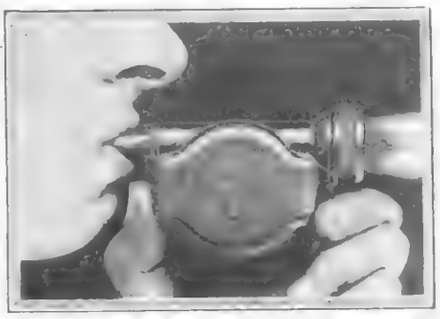




This illustration shows a new type of hand-soap tablet put in a suitable container. Each tablet presents enough soap for one washing, and is removed from the bottom of the holder.—Ernest Coler.

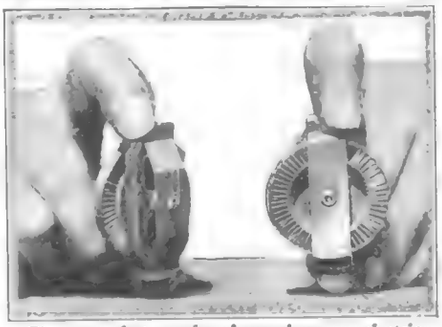


A very unique can opener is illustrated above. This can opener will remove the top of any shape of can. The cutter itself cuts down into the top instead of cutting around the edge. The teeth grip the sides of the can.—Walter J. Shampel.

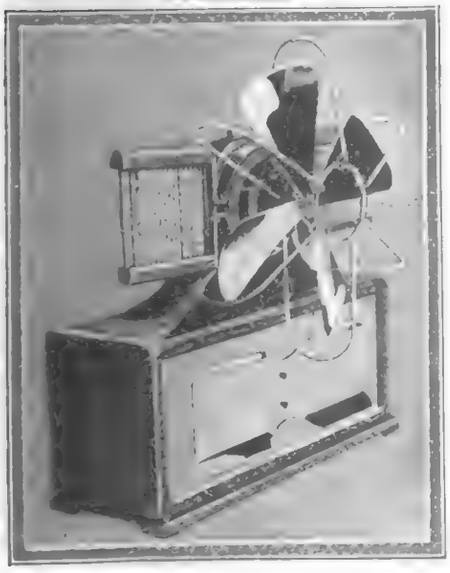


The secret of a long drive on the links depends upon the speed of the head of the club at the time it makes contact with the ball, and this speed can best be obtained when the club is held loosely. This grip permits of relaxation.—P. A. Vaile.

The above photograph shows a new type of compressed air scooter. It will be noted that the device runs on two wheels and is steered by turning the front wheel. The tank at the back furnishes the air for driving the scooter and the supply may be replenished at any "free air" gas filling station.



The two photographs above show an electric lamp which requires no batteries. This is a French idea. The dynamo is rotated by the turbine which is operated by blowing into the tube. The turbine rotates so easily that the light can be kept going for a long time without producing the usual tiring effect. The action is almost that of breathing.—N. C. McLoud.

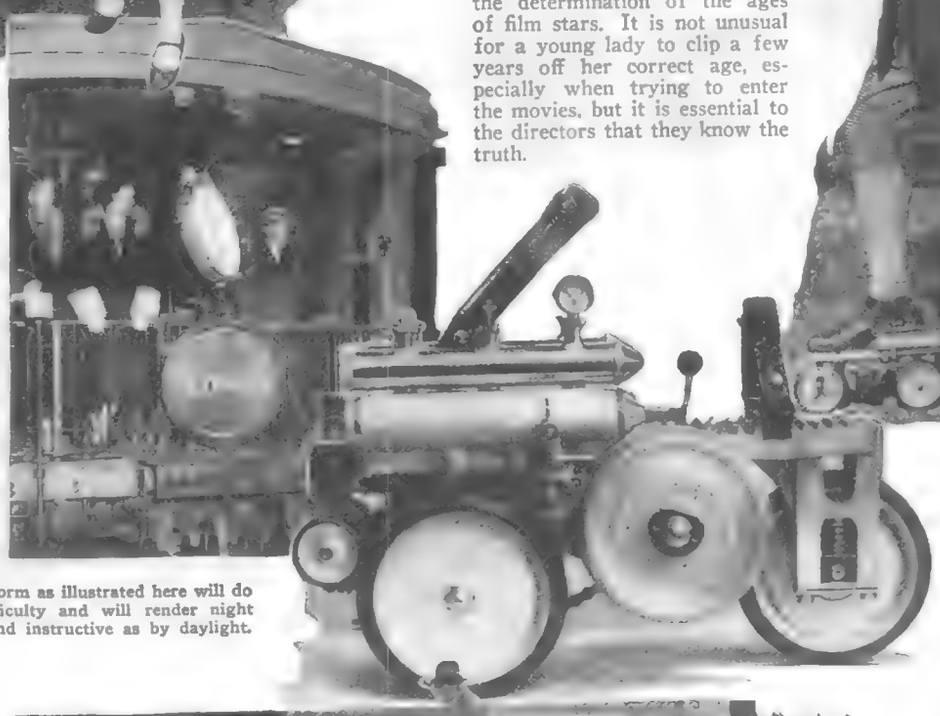


The photograph shows an apparatus for purifying the air in a room or for passing perfumed air through the room. The webbing in back of the fan dips into an essence of salt or balsam, producing an effect of sea air or pine forests.

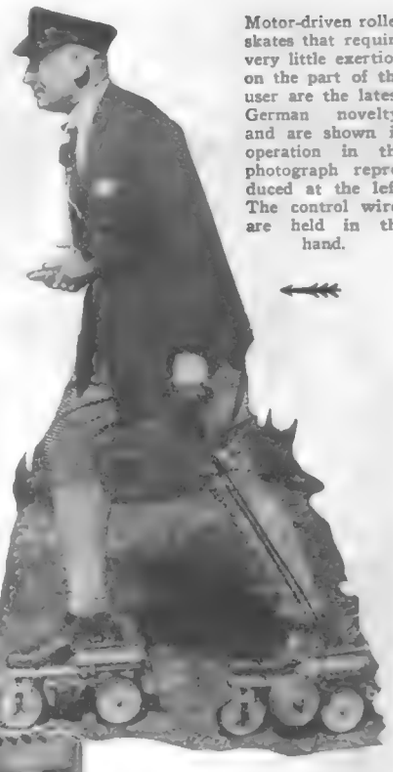
The latest development in check insurance is the application of the finger-print identification method to the signature. The pad holds the ink and a cleaning paste.

Interesting Bits of Science

IN the last few years, science has pursued the teller of untruths relentlessly with its knowledge and has succeeded in constructing several different devices that make it possible to mechanically detect whether or not a person is telling the truth. Several devices of this nature have been described heretofore in the pages of this publication and one of the very latest models is shown in operation at the immediate left. The gentleman standing behind the instrument is its inventor, Herbert Lapham, psycho-analyst and the subject of the experiment is Miss Dolores del Rio. She has been asked her correct age and the machine will immediately reveal whether or not the "Twenty" that she answers is correct. One of the important uses of this device is said to be the determination of the ages of film stars. It is not unusual for a young lady to clip a few years off her correct age, especially when trying to enter the movies, but it is essential to the directors that they know the truth.

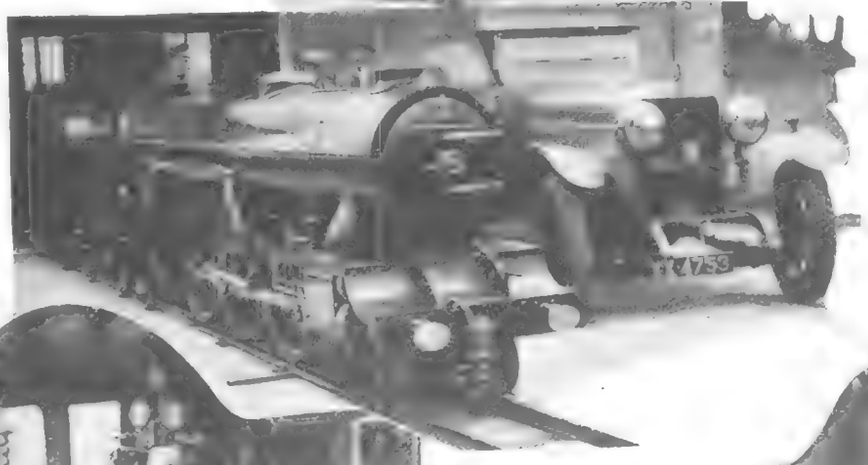


When traveling through a scenic region after dark, much of the beauty of the trip is spoiled because of the fact that the observation platform after dark on a moonless night is of little value to the sightseer. This is one of the greatest drawbacks of the through Transcontinental trains, as much interesting country is passed over during the hours of darkness and thus its beauty is lost to the tourist. However, the powerful search-light installed on the observation platform as illustrated here will do away with this difficulty and will render night travel as pleasant and instructive as by daylight.



Motor-driven roller skates that require very little exertion on the part of the user are the latest German novelty, and are shown in operation in the photograph reproduced at the left. The control wires are held in the hand.

ONE of the roller skates shown in operation above is illustrated in the close-up photograph at the left. The power for driving these roller skates is furnished by tiny acetylene gas-driven motors. It is possible o roll along at quite a respectable rate of speed with these skates and use of acetylene gas in the efficiently designed motor reduces the operating cost considerably below that found if gasoline is used. These roller skates were designed by Gebhardt, a noted automotive engineer of Germany, who has recently concentrated his efforts toward the production of small, light-weight high-powered engines particularly adaptable for use in airplanes and other places where light weight, economy and great power are paramount.



Miniature railroading is a most interesting hobby and is one that is engaged in by Captain J. E. P. Howey, English racing motorist. Illustration at the right shows one of the engines of his railroad being driven from its shed.

The photo at the left shows the interior of the cab of one of the locomotives used on Captain Howey's miniature railroad system. Eight miles of track are now available and the locomotive in use will draw coaches carrying 300 passengers. The power of the engine, whose cab is shown at the left, makes it possible for it to draw a load of 75 tons.

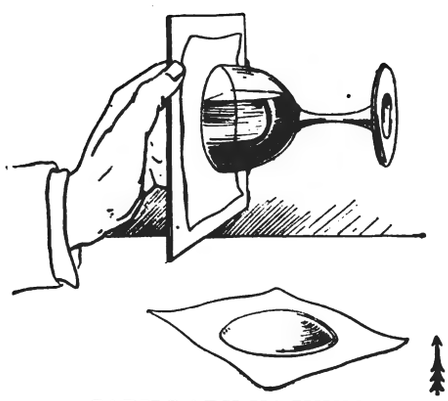
The odors preferred by insects are studied by means of the device shown above, so that proper bait for traps or poisons can be determined.

Odds and Ends of Physics

By PROF. T. O'CONOR SLOANE, Ph.D., LL.D.

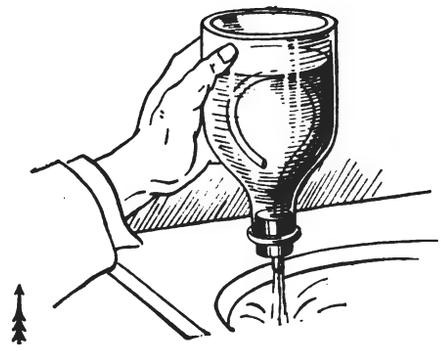
THE experiments illustrated on this page illustrate capillarity and phenomena of water pressure due to siphon action and some demonstrations of surface tension of water. The surface of water in its action is comparable to a sheet of thin elastic rubber. In the pores of the blotting paper, the little surface areas creep along the opening and drag the water after them. In the experiment with the needle and loop of thread, it is the surface tension that does the work. If one watches a drop of water, say on the edge of a window blind, you could picture to yourself that the film of water forms a little bag to hold the fluid, and when it gets ready to fall, a neck forms above it next to the wood, and this is illustrated beautifully in the experiment shown below in this column. The presence of alcohol reduces surface tension in water, and this is why, because of the unaffected water outside, the thread is drawn into a circle and the needle floats because of surface tension. The experiments with siphons speak for themselves and will be readily understood by our readers.

It is the old story of water seeking its own level told in experiments. In the siphon water acts as if it were a rope passing over a pulley.



CAPILLARY VACUUM

A piece of thick blotting paper is placed upon a piece of glass. A wine glass is filled brimfull of water. The glass and paper is placed upon it and it is inverted on the table. The paper is drawn into the glass by the vacuum and the glass can be held as shown. Evaporation of the water from the blotting paper increases the vacuum.



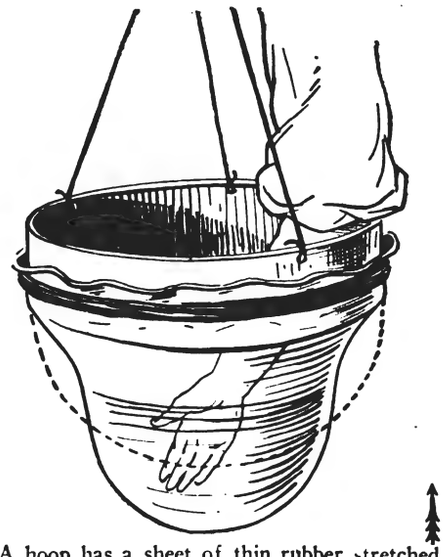
THE CUP OF TANTALUS

This shows the cup of Tantalus. On pouring water into it, it fills until the top of the siphon is reached, when it starts to empty out through the bottom. A figure representing Tantalus may be made to cover the siphon. For the mischievously disposed this is a good trick cup, and the victim may fill it innocently, when it will suddenly begin to pour out on his feet or lap.

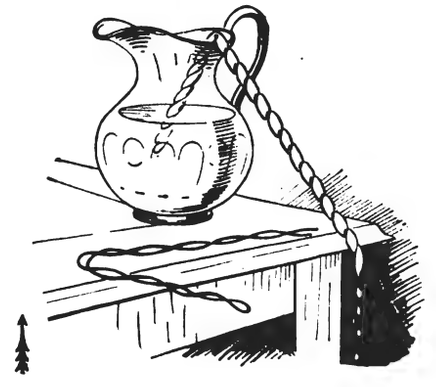
SURFACE TENSION

A loop of thread is floated on water. Touching the water inside it with alcohol, the loop flies out into a circle. By using a bent hairpin, a needle can be floated upon water.

GIANT WATER DROP

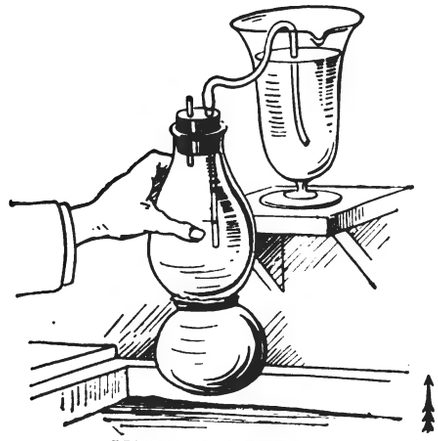


A hoop has a sheet of thin rubber stretched tightly across it. By pouring in water the illustration of the formation of a water drop is beautifully produced. Immersing the hand in the water depresses the rubber and upon lifting the hand out the rubber will spring back.



CAPILLARY SIPHON

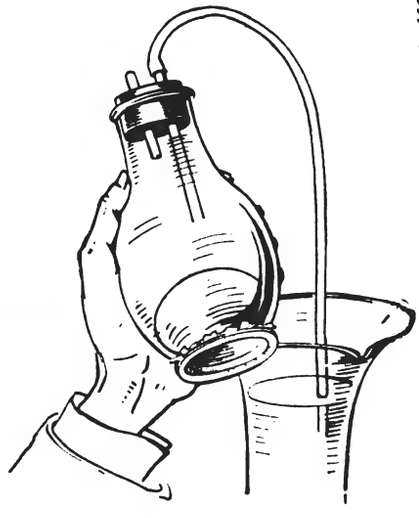
A bent wire has a lamp wick wound around it as shown. The wick is thoroughly wet, and when placed as shown will act as a siphon, and will keep up a continuous drip. This is of use for nursing invalids, where a bandage or compress is to be kept moistened for long periods.

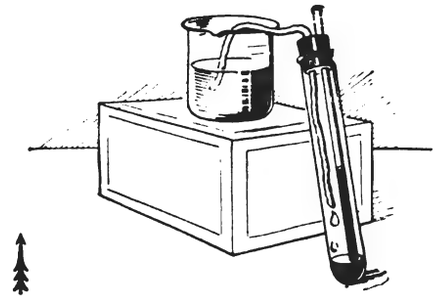


SIPHON ACTION

A lamp chimney with a piece of thin sheet rubber tied over its end demonstrates the action of the siphon when placed below the level of the water in the graduate. On the right is shown the action when above the level of the water.

In this case the longer arm of the siphon exercises suction upon the water in the lamp chimney drawing the India rubber inwards.





PRESSURE DUE TO SIPHON

Mercury is contained in the bottom of the test tube. The cork fits tightly. As water is siphoned into it, the column of mercury is forced upward by the pressure produced. It is an excellent demonstration of siphon action. The siphon must be started with the cork out of the tube, and then the cork is put in as quickly as possible.

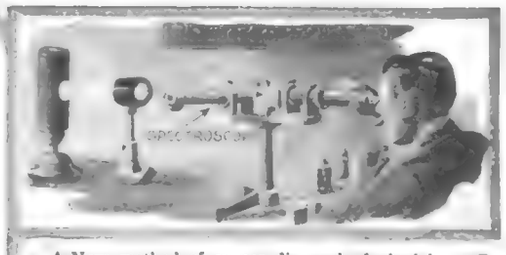
This may be taken as a version of the experiments with the lamp-chimneys and India rubber diaphragm. The mercury acts as the elastic sheet of India rubber did. Another way of utilizing the mercurial column is to place the beaker below the test tube when air will bubble through the mercury.

The Month's Scientific News Illustrated

By GEORGE WALL

In a most unusual accident which occurred in Fresno, Calif., George Krabian received contusions of the right chest, produced by one of his car's rubber tires when it suddenly left the wheel, struck a locomotive and rebounded in the manner shown.

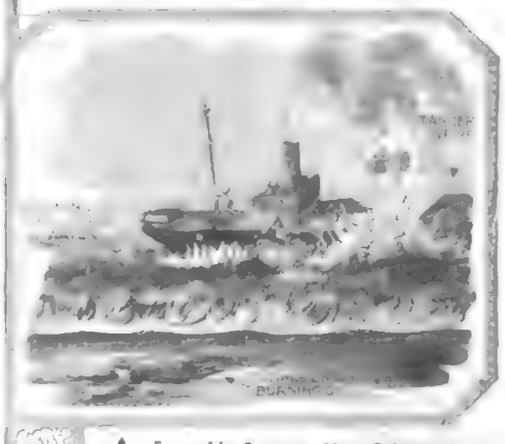
While a number of inventors have advocated the use of a large parachute for the purpose of saving a falling airplane, here is the latest idea for such a device.



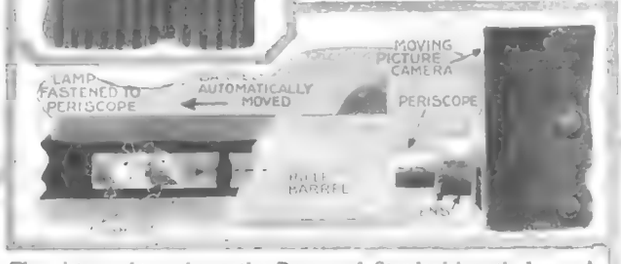
New method of cancer diagnosis devised by a German scientist, whereby this disease can be detected by examining a few drops of the patient's blood. The blood is examined spectroscopically.

Out in the Green River Canyon, Washington, flames shoot high in the air from a pool of cold salty water. Gas passing up through the water is ignited whenever a match is thrown in the pool. Sometimes it sinks almost out of sight.

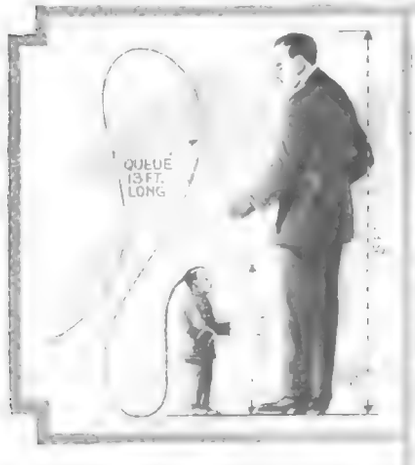
Fall River, Mass., recently had its electric current supply cut off because Pussy attempted to get a sparrow for breakfast, and short-circuited a transformer.



In a ship fire near New Orleans, some of the crew saved their lives by jumping overboard and swimming under water until they got beyond the range of the burning oil on the surface.



The picture above shows the Bureau of Standards' method employed for photographing the interior surface of a rifle barrel. A long periscope carrying an electric light is inserted in the barrel, and a special lens and movie camera photographs the interior of the barrel. Six exposures takes the whole interior.



How would you like a braid of hair thirteen feet long? Not only that, suppose you were a midget and stood only 23 inches high? As shown in the interesting picture above there actually was a man of this small stature who possessed a queue 13 ft. long, and his name was Che Mah. This famous midget was for years a stellar attraction of Barnum and Bailey's circus and died recently at the age of 38. He died leaving a good sized fortune.

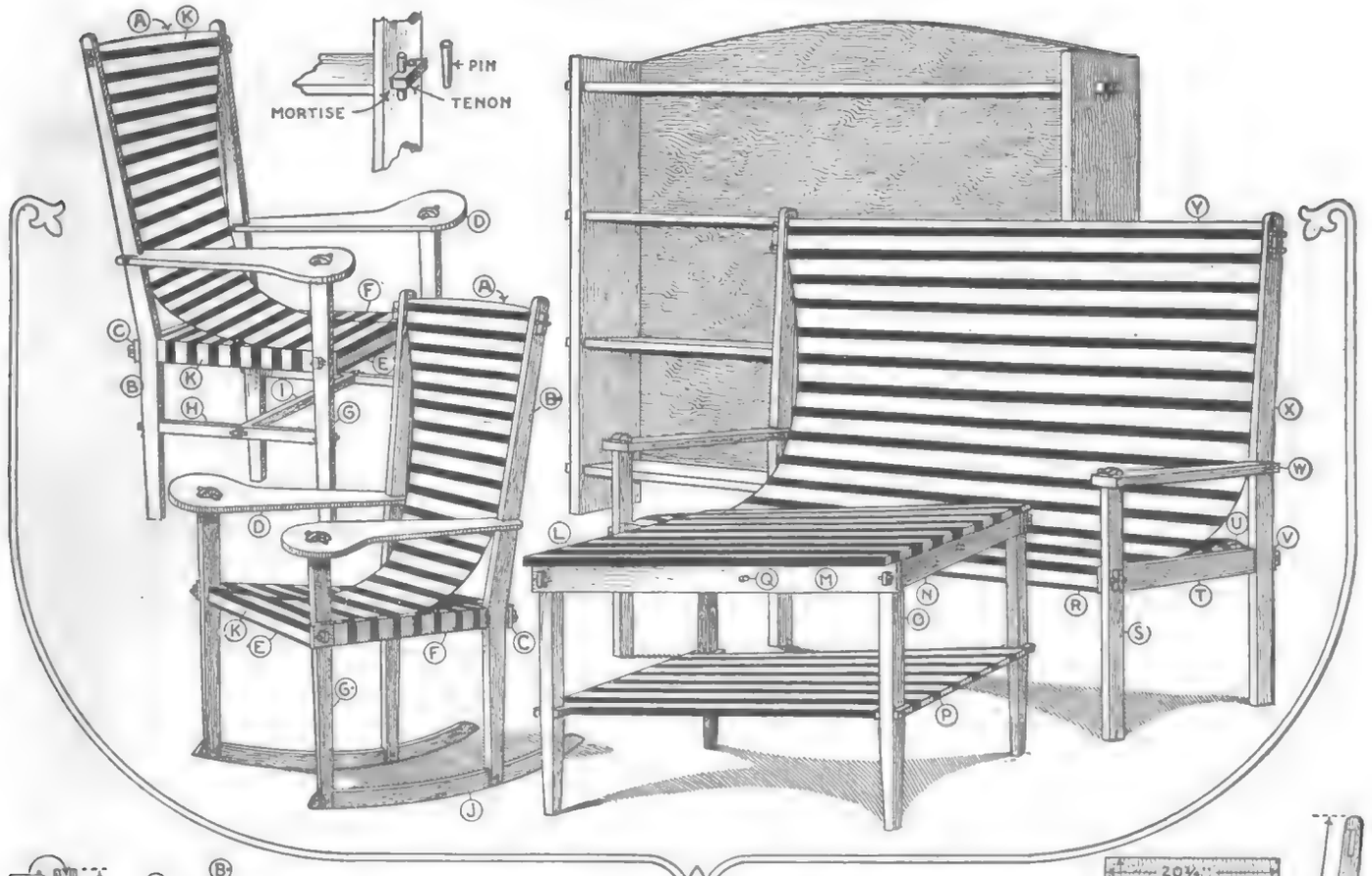
Walter D'Arcy Ryan, illumination engineer, proposes to project movies against a smoke screen at Atlantic City soon.

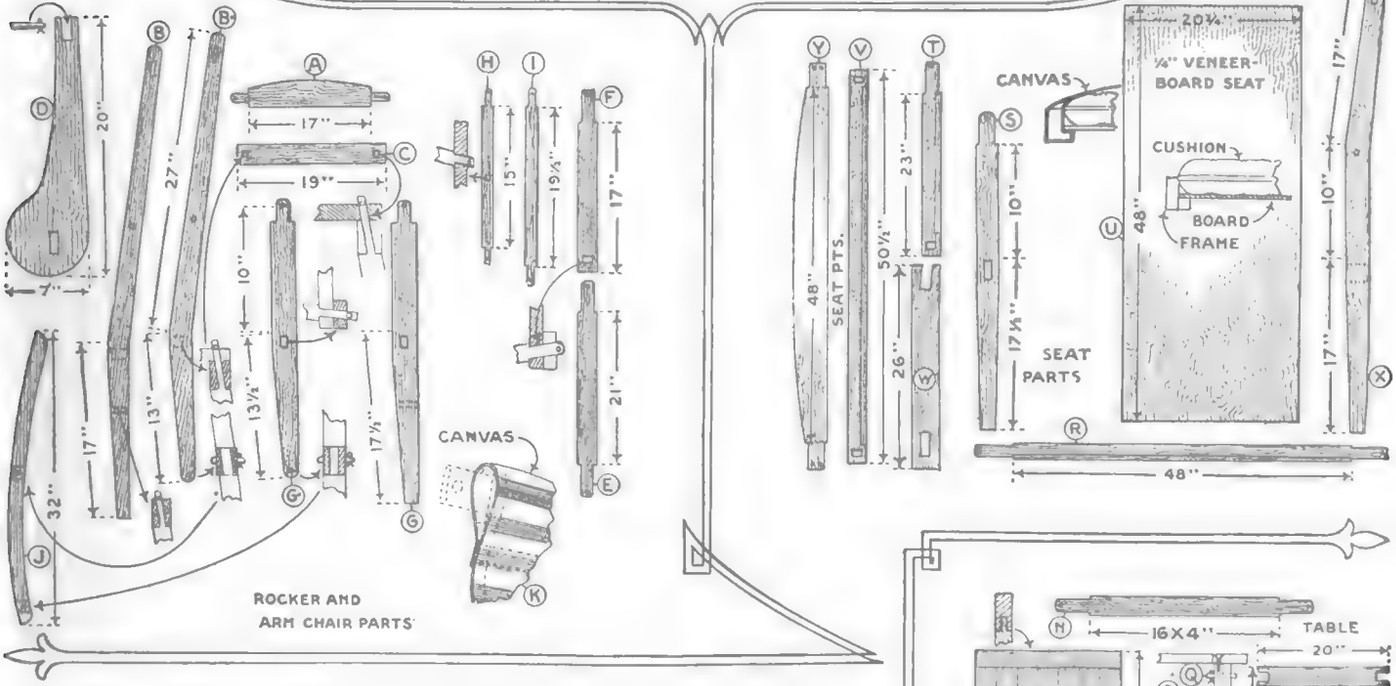
The gigantic Sesqui-Centennial Exposition at Philadelphia this year boasts of a huge Liberty Bell mounted over the entrance gates to the exposition. The appearance of this seventy-foot bell is illustrated above. It weighs 42 tons and is illuminated at night by 26,000 incandescent lamps, enough to light up a fair sized town in brilliant fashion and provide a "white way" in the bargain. This represents but one of the many magnificent displays at the Philadelphia exposition.

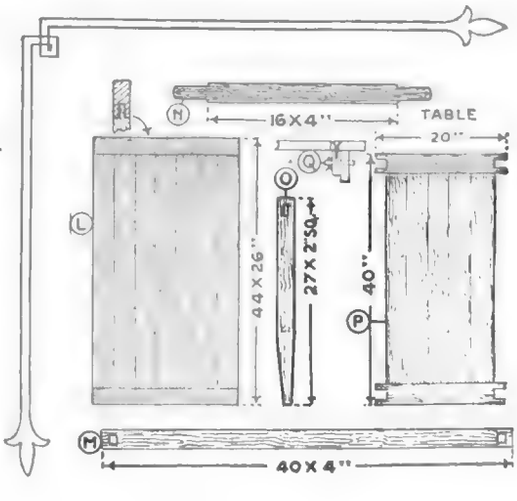
The picture at the left depicts an ingenious scheme for showing motion pictures against a smoke screen, as proposed by a well-known lighting expert. This stunt is to be tried out in connection with a proposed permanent international exposition for Atlantic City, N. J. Similar schemes to this have been proposed and tried out before for advertising purposes with clouds as a background, but this is too much of a gamble. A smoke screen should solve the problem quite successfully.

Knock-Down Porch Furniture

By WILLIAM M. BUTTERFIELD







THERE is always considerable interest in porch and other out-door furniture. The drawings herewith show how to build an armchair, a rocker, a table, a settee, and a bookcase. Oak is probably the best wood out of which to build this furniture, as it is very strong and will give the longest service. Moreover, the oak finishes up very nicely with a minimum of trouble, the dull wax or oil finish being simple and easy to apply. The furniture may be given a coat of the new popular gray stain and then finished with wax, or else a coat or two of thin varnish. There is a secret about applying the much desired gray stain, and it involves the mixing of white paint or white lead with the stain, until the desired color is obtained. Mix sufficient stain to finish the whole job to avoid matching colors. One inch oak material is used for armchair and rocker. A seat made of one-fourth inch veneer board is used on the chairs. The table top and shelf as well as the chairs, are covered with striped canvas. The bookcase is made of any desired size of three-quarter inch oak; the back is made from one-fourth inch veneer board.

Tarrano the Conqueror

THIRTEENTH INSTALLMENT

By RAY CUMMINGS

First American and Canadian Serial Rights

Up there in the clouds a gigantic image of Tarrano was materializing! His head and shoulders. Arms folded; his face with a sardonic smile leering down at us! Lips moving. And out of the air about us came his audible, broadcasted words.

"Do your best, my friends!" Ironic mockery. "Coming to conquer Tarrano? Hasten! You are keeping Tarrano waiting most impatiently!"

SYNOPSIS

IN the spring of the year 2325, all of the rulers of the various countries of the earth are mysteriously murdered. Jac and Grayson, employees of a large news organization, find that the murders are the result of a plot on the part of the inhabitants of Venus. Tarrano, an erstwhile lower official of the Cold Country of Venus is found to be at the head of a plot to rule the universe.

Dr. Brende, a friend of Jac's, has discovered a medical method whereby human beings may be kept from growing old. The Doctor is killed by a group of "Venus-Men" and Jac, Elza, the Doctor's daughter and Georg, the Doctor's son, are captured and taken to Venia, a city on the earth inhabited by people of Venus.

The next day, Tarrano offers to return the papers and models of the invention made by Georg's father, which he has confiscated and brands young Brende as an impostor. To offset this accusation, Georg is to tell his story to the earth as well as to Venus and Mars by radio and helio. He and Princess Maida go to the station but there they disappear.

Jac, Wolfgar and Elza, still captives, are removed from their prison and taken to the top of an enormous tower. Here, in the instrument room, where communication with the various planets is held, they view the disappearance of the Princess Maida and Georg by television. The abduction has been done by Tarrano's agents. On Mars, Tarrano's followers are attacking the ruling class and Tarrano offers Dr. Brende's secret to the public if they will surrender to his cohorts. They agree. Tarrano then announces to the Earth people, that he will not give them the Brende secret and declares war upon them. Wolfgar is a guard in disrepute.

The air war vessels of the Earth government start to attack Venia, but Tarrano sends up a bomb of surrender and then, with Elza, Jac and Wolfgar, he escapes through an underground passageway to a space-flyer. They go on board and are taken to Venus to where Georg and the Princess Maida have previously been transported. They are royally welcomed and go to the palace of the Princess Maida. Here they are attacked by Argo, one of Tarrano's men, who shoots a violet-colored beam of light across the room, separating Maida from the rest of the party. He threatens to kill her, when suddenly Wolfgar throws himself into and through the violet beam.

Wolfgar dies soon after he confesses to Maida that he loves her and Maida has made a similar declaration.

The evening after the burial of Wolfgar, Jac chances to be alone in a small boat near the palace and he is warned by a "slaan," a Venus man, to guard himself well. He also sees below the surface of the water and encased in a diver's cap, the face of an Earth man. Later that evening, preparations are rushed through for the great Water Carnival of Venus and to it proceed Georg and Maida; Elza and Tarrano; and Jac without a partner.

At the carnival all of the inhabitants of the planet are seemingly given over to the pursuit of pleasure and love. However, there is a vicious undercurrent of events noticeable to Jac but which does not seem to claim the attention of Tarrano. At one place there is a swimming pool in which girls are constantly sporting themselves. Watching them, Jac sees one of them drag a Tarrano guard to the edge and with him grasped in her arms, plunge into the pool. A few seconds later the girl comes to the surface but the man is never seen again.

Toward the climax of the celebration, a notorious Venus character, the Red Woman, performs a dance particularly for the benefit of Tarrano. In the midst of it, the large hall in which it is being held, suddenly is darkened and rays of death shoot out over the place. Jac, forewarned, drops to the floor out of their range and throughout the entire assembly, "slaans" in the employ of Princess Maida wreak havoc with their long knives. The cry goes up, "Down with Tarrano. Loyalty, everyone, to your Princess Maida." The Venus people, followers of Maida, have revolted; the Red Woman is dead, but Tarrano—?

Tarrano escapes. Taking Elza with him he travels via aircraft to the Cold Country.

Back at Maida's palace, the tide has been turned against the "slaans." Maida and Georg are married and rule a section of Venus. Jac suddenly receives a telepathic message from Elza who warns him of danger and rushing to the top of one of the buildings they behold a huge black cloud rolling toward the city. Elza's message to Jac says:

"Death, Jac! Death to all the city! The black cloud of death!"

Tarrano showed the man-side of his nature at last when he invaded Lady Elza's sleeping room. Lady Elza was greatly surprised to wake up suddenly and to behold Tarrano. He made passionate love to her against her will, and finally after being repulsed, Tarrano turned ironical and bade her rise from her bed and get dressed at once, as they were going on a trip. Tarrano, accompanied by Elza, flew to the outskirts of the Great City, where Jac Hallen, Maida and Georg were, and here he attempted to destroy the inhabitants by causing a heavy black poisonous smoke to envelope the city. Those in the city are awakened in time and flee; Jac wanders through the forest and finally discovers Elza who has escaped from Tarrano.

CHAPTER XXX

The Monster

I STOOD frozen with horror; but as my brain cleared—awake at last to full rationality and consciousness—beneath the horror came a surging joy of the knowledge that at last Elza was near me. The scream was repeated; inactive no longer, I dashed the thicket branches apart with my arms and plunged forward through the darkness.

Ahead of me the thickets opened into a sort of clearing. I saw the sky, the stars—paling stars with the first flush of dawn overpowering them. I stood at the edge of an open space in the dim, flat-grey illumination of morning twilight.

Elza! She was there, standing near a huge isolated tree; Elza, pale, trembling, a hand pressed against her mouth in terror; disheveled, her garments dirty and torn with her wanderings through the forest.

A swift glimpse as momentarily I paused; a second or two only, but the scene was impressed upon my brain as actinic light upon a photo-screen. Close by Elza, partially behind her, I saw something small, no taller than Elza's waist. A naked thing of sleek, glistening skin. The monstrosity of a human child; a bulging head, wavering upon a neck incapable of supporting it; a thick round body; twisted, misshapen limbs. A face . . . human? It made my gorge rise with its gruesome suggestion of humanity. Nostrils—no nose; a mouth, lipless, but red like a curved gash with upturned corners to make the travesty of a grin; a triangle of watery eyes, goggling. Senselessly, it stood watching Elza with a dull, vacant curiosity. Not human, this thing! Yet monstrously repulsive in its hideous suggestion of an idiot child.

Elza was not facing it; my gaze instinctively followed hers to the tree. Crowning horror! The adult of this thing upon the ground hung swaying by a thick hand and arm from a low limb; hung, then dropped Growling, mouthing as though it would try and form human words of menace, it picked itself up and shambled toward Elza

I leaped for them. Elza seemed too terrified to run. The thing reached her, towered over her; seized her in its arms. She

screamed—the agony of revolt and terror; but over her voice rose my own shout of rage, and abruptly the thing dropped her and turned to confront me. Snarling, glaring with its three hideous blood-shot eyes; waving its thick, bent arms.

I had no weapons save those with which nature had endowed me. The regret of that came as a fleeting thought; and then I crashed into the thing; my fist, passing its awkward guard, struck it full in the face. I sickened. Even in the heat of combat a nausea swept me. For no solid flesh and bone met my blow. Like the shell of an egg, my fist crashed into and through its face.

Warm, sticky moisture . . . a stench . . .

The thing had toppled backward, with me sprawling upon its bloated bulk. It struggled, writhed . . . Its arms gripped me, its huge fingers clutched my throat . . . I caught a glimpse of its smashed face . . . so close, I turned away . . . a face of yellow-white pulp . . .

My fist cracked and sank into its chest. I pounded, smashed; broke the shell of its distended body . . . noisome . . . the revulsion, the nausea of it all but overcame me.

At last the thing lay still; and from the wet, sticky foulness of it I rose and stood shuddering. Elza lay on the ground; but she had risen upon one elbow and I saw that she was unharmed save for the shock of terror through which she had passed—a mitigated shock with the knowledge now that I was with her, and that I too was uninjured.

The infant thing had vanished. I hastened forward.

"Elza! Elza, dear—"

Joy lighted her face.

"Jac!"

I would have lifted her up; but the consciousness of my own foulness—the yellow-white slime streaked with red which smeared my arms, splattered my clothing—gave me pause. In the growing light, beyond the clearing, I caught the silver sheen of water. Without a word I ran for it; a shimmering pool the existence of which no doubt had drawn these grewsome beings of the forest into its vicinity. To the cleansing water I ran, plunged in, purged myself of that horrible foulness which human senses could not endure.

When I returned, Elza was upon her feet. Recovered at last she flung herself into my arms. Impulsive; seeking protection as she clung to me; fear; the let-down of overwrought nerves as she stood and clung and sobbed upon my shoulder.

It was all of that; but oh! it was more than that as well. My Elza, raising her tear-stained face and kissing me. Murmuring, "Jac, I love you!" Murmuring her love; "Jac dear, you're safe! I've wanted so long to be with you again—I've been so frightened—so frightened—"

Giving me back my kisses unreserved; holding me with eager arms . . . Tarrano? The memory of him came to me. How foolish my fears, my jealousy! That man of genius . . . conqueror of worlds . . .

But my Elza loved *me!* . . .

CHAPTER XXXI

Industriana

It must have been two days later when at last we were rescued by the Rhaal patrol and taken to Industriana. Back there in the forest I had suddenly remembered that the mate to the thing I had killed would doubtless be lurking in the vicinity. We fled. Subsisting on what food of the wilds we could find, at last we were picked up and taken to the City of Work.

The Great City had been destroyed. Wanton capital of the Central State, we learned now that it lay dead. To outward aspect, unharmed. Fair, serene, alluring as ever it lay there on its shimmering waters; but the life within it, was dead. Refugees—a quarter perhaps of the inhabitants—had escaped; hourly the search patrols were picking them up, bringing them to Industriana. Rescue parties were searching the city, to find any who might still be alive.

And out in the forest lay a great pile of ashes, still exhaling a thin wisp of its deadly breath—where Tarrano had created the Black Cloud; lost his captive Elza, but doubtless had escaped himself back to his City of Ice.

We found Georg and Maida safe at Industriana. Marvelous city! Elza had never seen it before. She sat gazing breathless as from the air on the patrol vessel, we approached it.

The land of this region was a black, rocky soil upon which vegetaton would not grow. A rolling land, grimly black, metallic; with outcroppings of ore, red and white and with occasional patches of thin white sand whereon a prickly blue grass struggled for life.

Rolling hills; and then places where nature had upheaved into a turmoil. Huge naked black crags; buttes; hills with precipitous black sides of sleek metal; narrow canyons with tumultuous water flowing through them.

In such a place stood Industriana. The city of work! Set in an area where nature lay scarred, twisted in convulsion, its buildings clung to every conceivable slope and in every position. Many-storied buildings—residences and factories indiscriminately intermingled. All built in sober, solid rectangles of the forbidding black stone.

A long steep slope from an excavated quarry deep in the ground, ran straight up to a commanding hilltop—the slope set with an orderly array of buildings clinging to it in terraces. Buildings huge, or tiny huts; all anchored in the rear to the ground, and set upon metal girders in the front. Bisecting the slope was a vertical street—a broad escalator of moving steps, one half going upward, the other down. Beside it, a series of other escalators for the traffic of moving merchandise.

Cross streets on the hill were spider bridges, clinging with thin, stiff legs. And at the summit of the hill stood a tremendous funnel belching flame and smoke into the sky.

To one side of the hill lay a bowl-like depression with a single squat building in its center—a low building of many funnels; and about it the black yawning mouths of shafts down into the ground—mines vomiting ore, broken chunks of the metallic rock coming up as though by the invisible magic of magnetism, hurtling through the air in an arc to fall with a clatter into great bins above the smelter.

(*Continued on page* 265)

Crowning horror! The adult of this thing upon the ground hung swaying by a thick hand and arm from a low limb; hung, then dropped. Growling, mouthing as though it would try and form human words of menace, it picked itself up and shambled toward Elza.

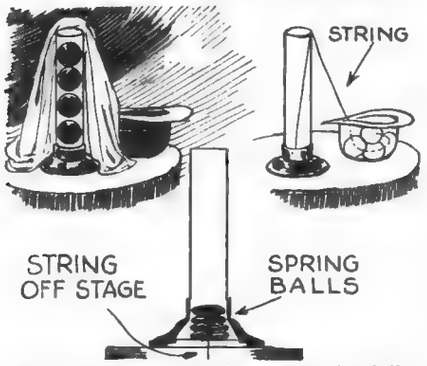
MAGIC By "DUNNINGER"

THE MAN WHO MYSTIFIED
Pres. Coolidge
Prince of Wales, Ex-President Harding, Taft, Roosevelt, and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION

Folks Are Mystified Yet Delighted by This Man!
Mind You! The Mind Reader Really Read the Mayor's Mind
DUNNINGER DRAWS HUGE BIG CROWDS
Dunninger Will Attempt To Hypnotize Patient, 10 Miles Away, by Radio

NO. 40 OF A SERIES

The Cylinder from Olympus

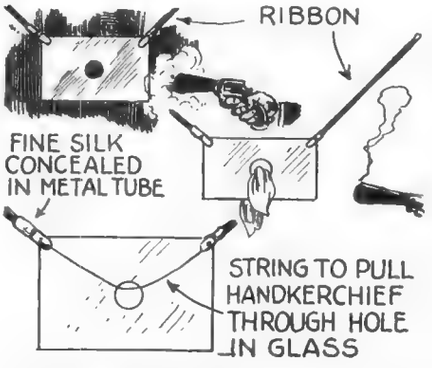


The above illustrations show how spring balls which have been substituted for the solid billiard balls are made to disappear from a glass cylinder.

This is a most unusual and impressive effect and may be added to any magician's program. Let us say that the magician had been doing some tricks with the multiplying billiard balls. He tosses these into a hat. He now produces a glass cylinder supported on a metal base. The cylinder is of course transparent and to all intents and purposes free from deception. He removes the billiard balls from the hat and places them in the cylinder, and covers it with an unprepared handkerchief and presto!—on removing the handkerchief the balls have vanished. The secret lies in the fact that the spring balls substituted for the solid balls, are put into the cylinder. A string passing from the upper spring ball terminates in the hand of an assistant, who by pulling the string crushes the balls into the base of the cylinder. The end of the string is then secured back of the stage and so it remains until the curtain drops. An end table is preferably used for the stand.

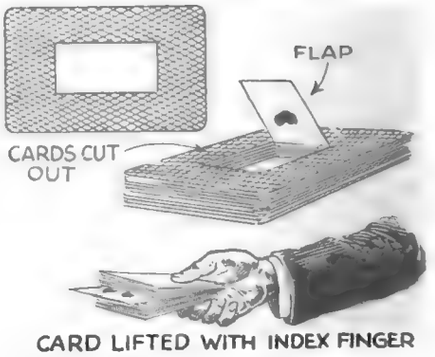
Mephistopheles' Glass Plate

A plate of glass measuring 12x14 inches is suspended in mid-air by means of two ribbons hanging from the flies. In the center of the transparent plate one will find a hole about 2½" in diameter. A handkerchief is shown and loaded in the funnel arrangement at the end of the performer's pistol. Standing at a distance of some twenty odd feet the performer fires the gun and the handkerchief is seen to mystically find its way through the hole in the plate where it is found projecting from both sides thereof. The explanation is extremely simple. Two identical handkerchiefs are employed and they should be of the finest China silk procurable. One of these is placed in the gun where it remains and the other is loaded in a metal tube arrangement on the lower end of the ribbon. A string is attached to this handkerchief, passes through the hole in the glass and to an assistant, who pulls the handkerchief into the hole.



The assistant pulling on the string at the report of a pistol causes the kerchief loaded in the small metal tube to be drawn through the hole in the suspended glass plate.

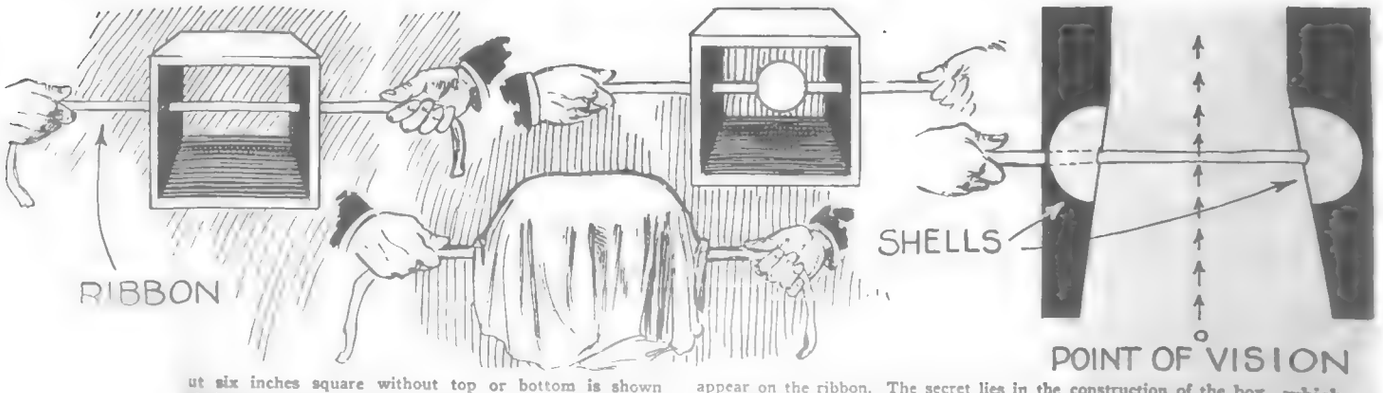
Rising Cards Improved



With the use of the prepared deck made as illustrated above a very pretty rising card effect can be produced which is almost impossible of detection.

Professional as well as amateur magicians are of the mutual opinion that a good rising card trick is one of the most spectacular and convincing effects in the entire realm of conjuring. An unprepared pack of playing cards is passed around for inspection. Three or four cards are selected and withdrawn by some of the audience and the rest of the pack returned to the magician, who holding it at arm's length asks that the selected cards be reinserted and one by one they are made to rise from the deck. To accomplish this the magician has provided himself with two decks of cards of an identical nature in one of which fifty of the cards are cut out in the center, one is partially cut out so as to form a flap, and the other uncut one is placed on the face of the pack. When the unprepared cards are inserted in this deck it becomes a simple matter to raise them one by one by pushing the index finger into the hole and advancing the cards in order.

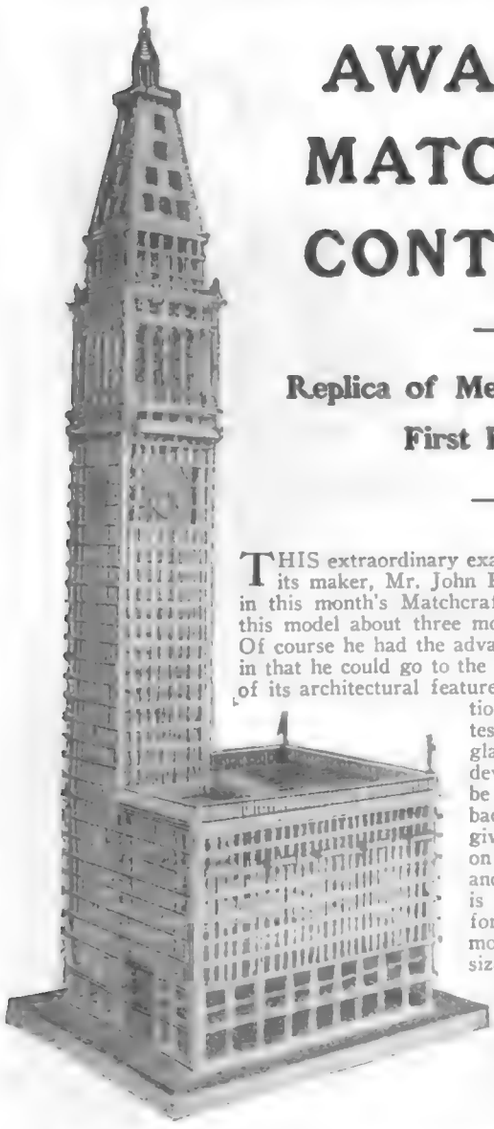
Chinese Box Trick



ut six inches square without top or bottom is shown
ed through holes in the sides of the box. The ends of the
two spectators, the box is covered for an instant by a
a billiard ball with a hole bored through it is caused t

appear on the ribbon. The secret lies in the construction of the box, which contains two metal hemispheres, through which the ribbon must pass in being threaded through the box. Under cover of the cloth, the shells are brought together at the centre and their edges joined.

AWARDS IN $5000.00 MATCHCRAFT CONTEST



Replica of Metropolitan Tower Wins First Prize--$100.00

THIS extraordinary example of the Matchcrafter's art, won for its maker, Mr. John Petry of New York City, the first prize in this month's Matchcraft Contest. Mr. Petry started to build this model about three months ago and kept at it on spare time. Of course he had the advantage over the folk living in other cities in that he could go to the tower and examine it and make sketches of its architectural features and duplicate them in match construction. In the model as submitted in the contest there is no celluloid used in place of glass in the windows. The openings are devoid of any material, although it would be a simple matter to place something in back of the window frames so as to give the effect of glass. The clock on the tower is also made of matches and does not actually run. Mr. Petry is thinking of substituting a timepiece for each of the clock faces when the model is returned. An idea of the size of the model can be obtained by comparing it with the photograph of Miss Franky DiOrio standing beside it. The height of the building is 11½ inches and the tower alone is 3 feet 2 inches. Approximately 15,000 matches were used in the construction.

$5,000.00 Prize "Matchcraft" Contest

WATCH FOR PRIZES IN AUGUST ISSUE

FOR the present year, SCIENCE AND INVENTION magazine will award a total of $5,000 in prizes, in a new contest. You are asked to make models, fashioning the same entirely from safety matches. Please observe the following simple rules:

(1) Models submitted must contain at least 90 per cent. safety matches in their construction.

(2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.

(3) Models can not be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.

(4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.

(5) Models may be painted, gilded or silvered.

(6) Models may be of any size.

(7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5"x7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled herewith.

16 Monthly Prizes

First Prize	$100.00
Second Prize	75.00
Third Prize	50.00
Fourth Prize	35.00
Fifth Prize	25.00
Sixth Prize	20.00
Seventh Prize	15.00
Eighth Prize	12.50
9th to 16th Prizes of $10.00 each	$80.00

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photos only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

(10) This is a monthly contest, lasting for twelve months, each monthly contest closing on the first of the month following date of issue. This contest for the month of July will close August 1, 1926, and prize winning announcements will be made in the October 1926, issue. The August issue will contain May prize winning entries.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, "Matchcraft" Contest, care SCIENCE AND INVENTION Magazine, 53 Park Place, New York.

Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

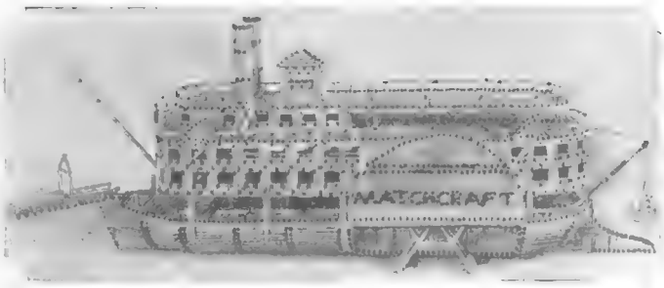
This contest started Dec. 1, 1925, and will terminate Dec. 1, 1926.

REMEMBER— This is a monthly contest offering sixteen prizes eve month. Don't hesitate, send in your model

MATCHCRAFT

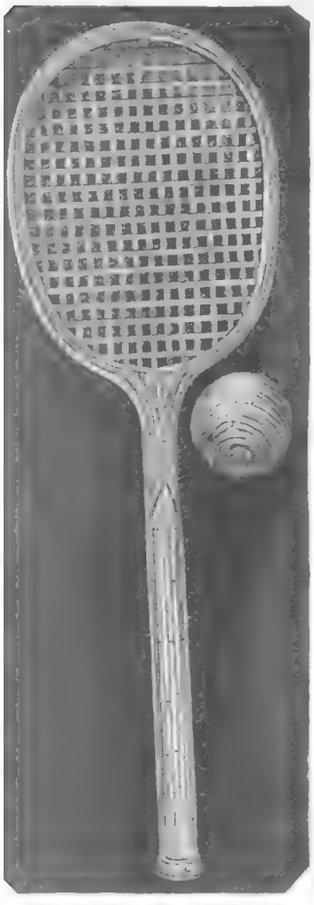
Boat Wins $75.00—Hat $50.00—Tennis Racket $35.00.

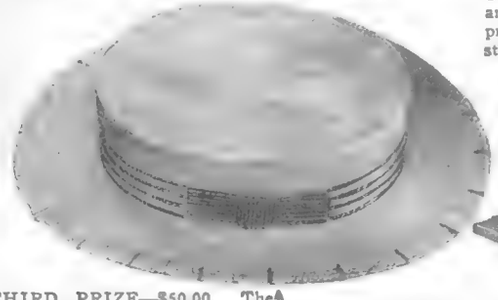
ECOND PRIZE — $75.00. he two photographs at the ght show the Matchcraft odel of a Mississippi River eamboat which won the sec-nd prize in this month's con-st. Note how realistically the ngplank and rowboat are sup-orted and also observe ow carefully the matches have en laid in place so as to form artistic pattern. The stair-ays in this model are also ade of matches and they can e clearly seen in the enlarged ew at the extreme right. The inner is John David Saug-ead of Ft. Thomas, Kentucky.



The photograph above shows another view of the second prize entry in which the steps leading to the decks can be clearly seen.

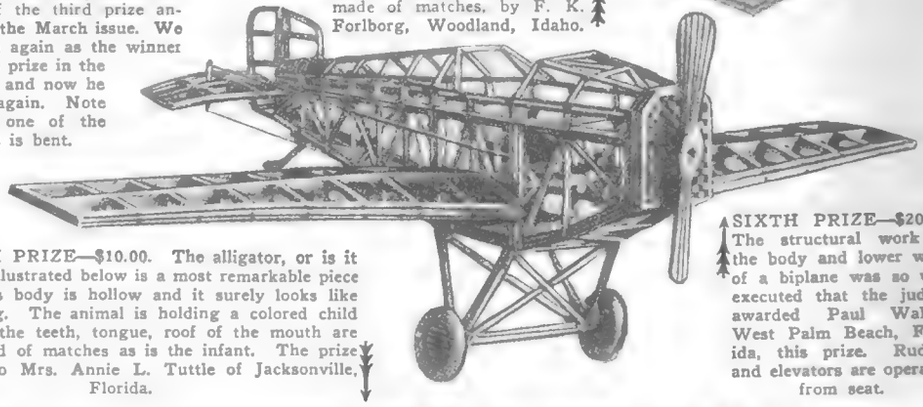
FOURTH PRIZE—$35.00. The very interesting model of a tennis racket and ball was made by Mr. Carl Fichtner of Philadelphia, Pa., who has been an aspirant for the first prize since the contest was started. It will be remembered that Mr. Fichtner won the ninth prize in the contest announced in the May issue. The ball is hollow and the strings on the racket are made of matches dove-tailed and very accurately fitted.





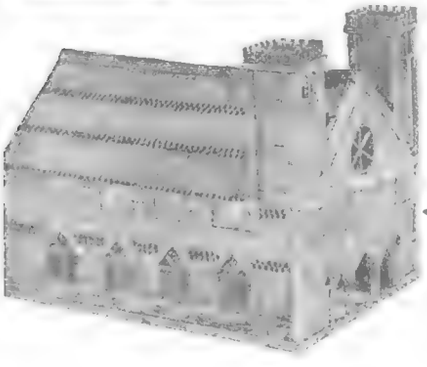
THIRD PRIZE—$50.00. The match hat shown here was made by Mr. Fred Spinden of Abingdon, Illinois. Mr. Spinden was a winner of the third prize announced in the March issue. We hear of him again as the winner of the ninth prize in the April issue, and now he is with us again. Note that every one of the matches is bent.

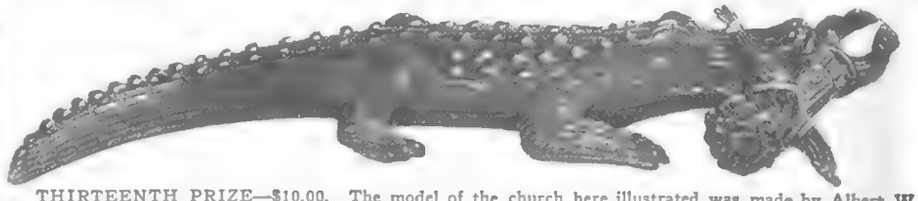
EIGHTH PRIZE. — $12.50 California Mission, trees, bells and entire construction made of matches, by F. K. Forlborg, Woodland, Idaho.



SIXTH PRIZE—$20.00. The structural work of the body and lower wing of a biplane was so well executed that the judges awarded Paul Walter, West Palm Beach, Florida, this prize. Rudder and elevators are operated from seat.

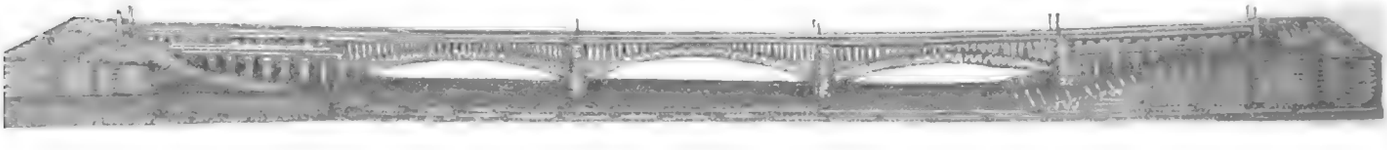
ELEVENTH PRIZE—$10.00. The alligator, or is it a crocodile? illustrated below is a most remarkable piece of work. Its body is hollow and it surely looks like the real thing. The animal is holding a colored child in its jaws; the teeth, tongue, roof of the mouth are also composed of matches as is the infant. The prize is awarded to Mrs. Annie L. Tuttle of Jacksonville, Florida.





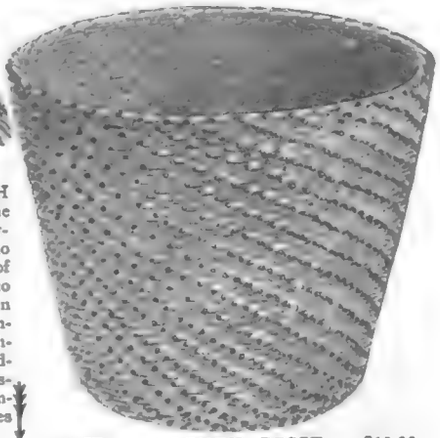
THIRTEENTH PRIZE—$10.00. The model of the church here illustrated was made by Albert W. E. Henne of Denver, Colorado. This model was not painted and its lines can be clearly seen from the photograph here given. Most of the models which are submitted come in unpainted and it is better that they are not painted because the match construction can be shown more clearly in the photographic reproduction. It is hard to show how these models are built up when they are covered with a thick paint.

FIFTH PRIZE—$25.00. It is impossible to do the model of the Illinois & St. Louis Railroad Bridge shown below any justice. The girder construction on this model is made of matches which are split in order to make them thinner in comparison with the main supports and the horizontal girders. Beneath the top road bed four parallel tracks are laid for the trains. Note the ruler in the photograph. This model was built by David Savidge of Tower City, Pa.



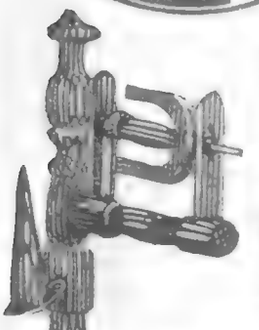
Flowers, Baskets and Pens Now Made of Matches

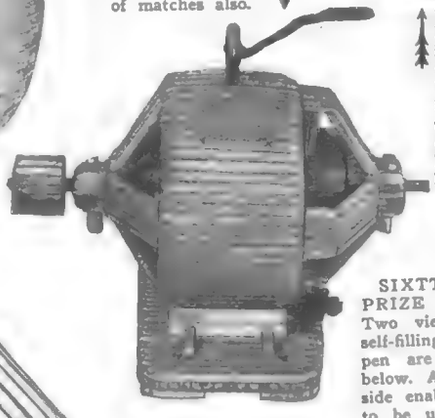
FIFTEENTH PRIZE $10. The motor below or perhaps it is a dynamo is built entirely of matches. In order to make the construction more nearly one hundred per cent matches, Mr. Walter Hudson of Milton, Wisconsin, made commutator and brushes of matches also.

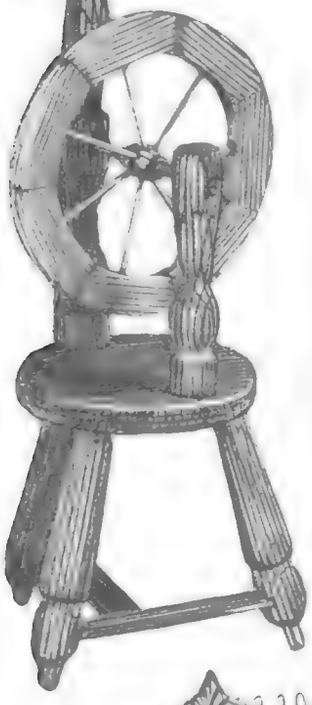


TENTH PRIZE — $10.00. Exercising great care in laying his matches in place, Mr. Charles J. Lovell, of Clinton, Maine, made this waste paper basket. He used the ordinary type of strike-anywhere matches, but made them safety by cutting off the striking heads on each and every one of the matches.

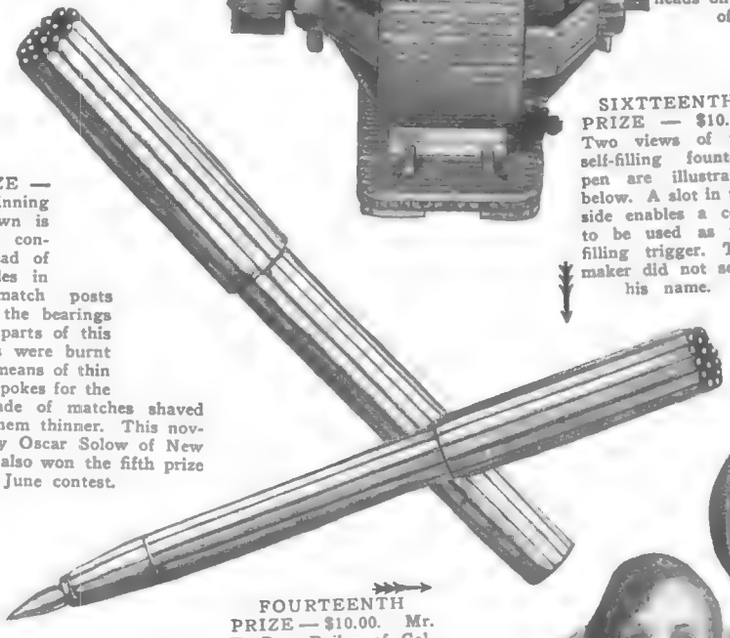
TWELFTH PRIZE — $10.00. After carefully bending his matches to form a vase, and gluing them in place, Mr. Eugene Jefferies of Anacorts, Washington, carefully sandpapered the vase inside and out, smoothing it down. Not being satisfied with a plain vase, he decided to make flowers of split matches. Miss Dorothea A. McGarity appears above and close-up of vase.



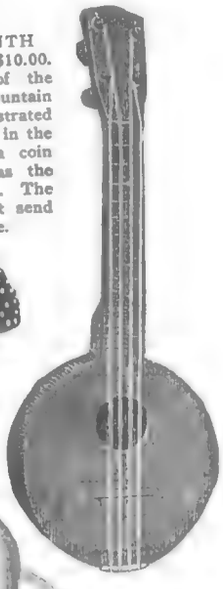




NINTH PRIZE — $10.00. The spinning wheel here shown is also of match construction. Instead of drilling the holes in the wooden match posts which serve as the bearings for the moving parts of this wheel, the holes were burnt in the wood by means of thin hot wires. The spokes for the wheel were made of matches shaved down to make them thinner. This novelty was built by Oscar Solow of New York City, who also won the fifth prize in the June contest.



SIXTTEENTH PRIZE — $10.00. Two views of the self-filling fountain pen are illustrated below. A slot in the side enables a coin to be used as the filling trigger. The maker did not send his name.



FOURTEENTH PRIZE — $10.00. Mr. E. Don Bailey of Columbus, Indiana made the banjo-uke illustrated here. It is being played by Miss Ruth D. Olsen. The body, sides and back as well as the neck and head are made of match construction. It may be remembered that Mr. Bailey won the fifteenth prize for the battleship which he made and entered in the April Matchcraft Contest. An enlarged view of the uke is also illustrated.

SEVENTH PRIZE $15.00. This beautiful partheon-like building with its myriads of columns was built by Mrs. E. V. Schepper, Astoria, Long Island, who won the Fourteenth Prize in the June issue and the Second Prize in the May issue Matchcraft Contests. There is a carved figure in the building which can be seen through the front doors.

MODEL DEPARTMENT

Locomotive Wins Third Science and Invention Trophy Cup

Harry L. Woodson of St. Louis, Missouri, Is Awarded This Month's Prize.

Each month this publication awards a handsome cup 15½ inches high and weighing nearly five pounds for the best model submitted during the month. The model can be a ship, an airplane, a submarine, an engine or in fact anything. Photograph of the cup, the certificate of award and the locomotive model which won it is shown at the right. Mr. Woodson and his model are shown in the photograph at the left.

Mr. Harry L. Woodson, who won the third cup for his model of a locomotive and tender built this model of odds and ends of material. The boiler of the locomotive is made of a sheet of copper, seamed and soldered at the bottom. The cylinder is made of a piece of brass tube and the box on top of it was poured directly on the tube, using a mixture of solder and Babbitt metal. The sliding valve was made of Babbitt. In the construction of this engine, the soldering iron is the main tool.

Rules for Model Contest

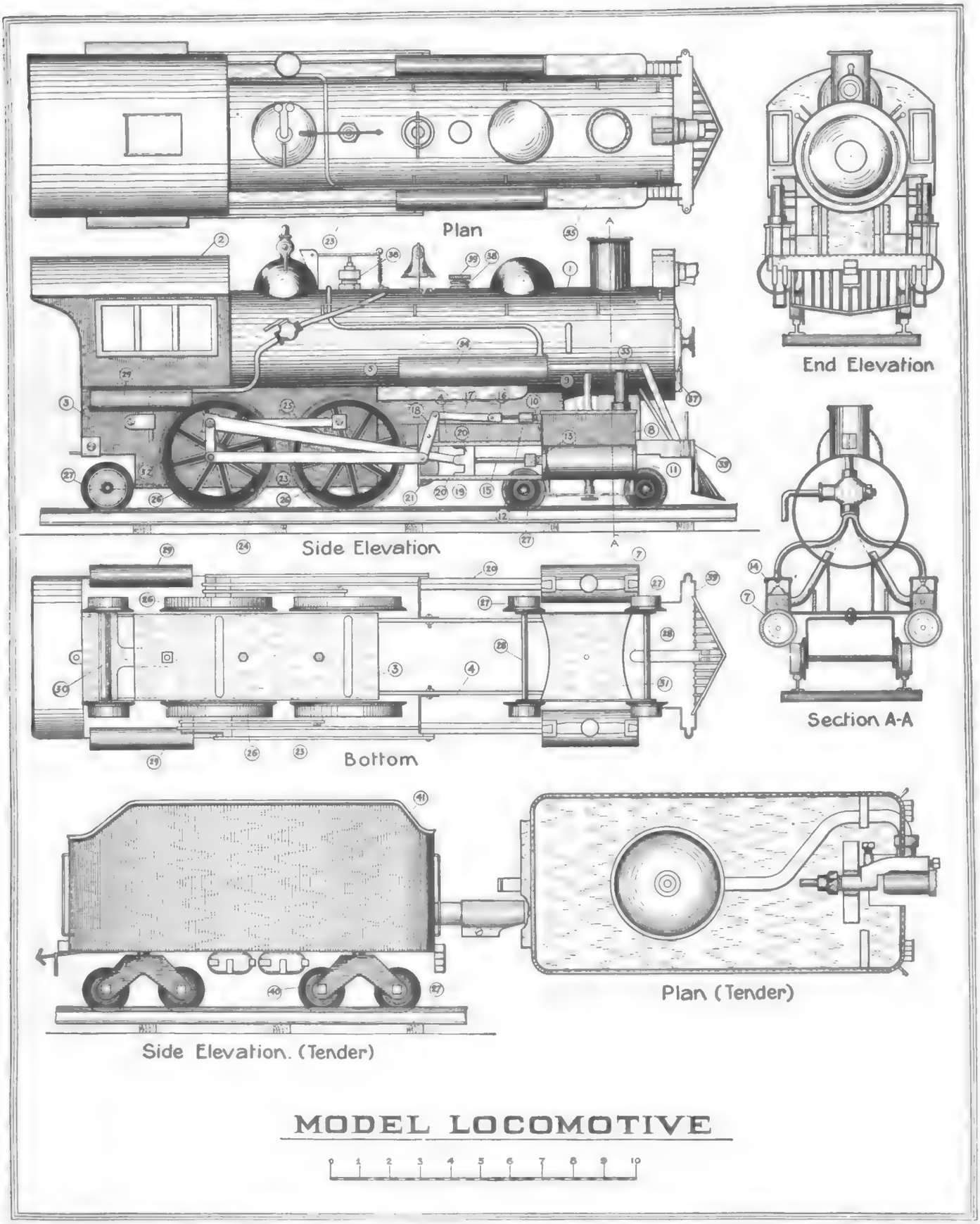
1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight, prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the September contest must reach us on or before the 25th of June.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

This is a close view of the locomotive and tender. The tender houses the gasoline blow-torch, the nozzle of which projects under the boiler. Note how the paint on the pit beneath the boiler has been cracked due to the intense heat. Because of the large bore and long stroke of the engine, the locomotive develops a surprising amount of power. The head-light on the front is wired to two flashlight batteries clamped beneath the tender.

A CUP A MONTH—Who Will Be The Winner In August?

Model Locomotive With Gasoline-Fired Boiler

Drawings Show the Assembly of the Model Locomotive Which Won the Third SCIENCE & INVENTION CUP.



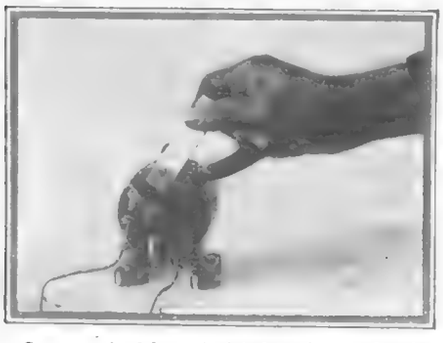
THE model locomotive (assembly drawings shown above) was made entirely of scrap parts by Mr. Harry L. Woodson of St. Louis, Missouri. The scale at the bottom of the drawings is in inches. With its aid, one can obtain the comparative size of the various parts of the locomotive. This locomotive has an ordinary cylindrical boiler which in this particular model was made of a strip of copper seamed at the bottom and hard soldered. The steam exhausts into the smoke stack. The cylinders are made of brass tubing and the metal for the valve chambers is poured on each tube with half solder and half Babbit metal. The cylinders have a one-inch bore and the pistons have a two and one-quarter inch stroke. The tender contains fuel tank and torch.

A cup is awarded every month. Send your model in now.

Experiments With Ozone

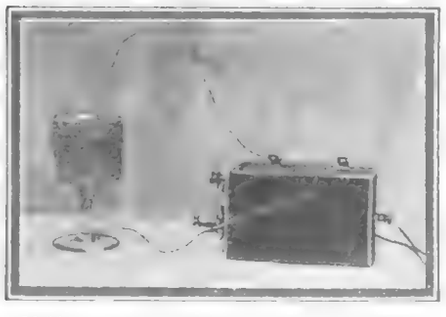
By RAYMOND B. WAILES

OZONE is the stuff which is popularly believed to give the tang to ocean breezes, and the freshness to the country air. It is really an allotropic form of oxygen, masquerading under a made-over countenance, with nose stuck high into the air. But, despite its haughtiness, it is very easily cleft down to another notch, to be once again ordinary oxygen. Such high-faluting properties can be easily imparted to oxygen or air, and then again rapped on the shins and made to assume their normal state, as the following experiments show.



Ozone evolved from the brushes of a toy electric machine.

Most of us have noticed the peculiar garlic-like odor in the atmosphere surrounding motors, even of the small toy type. The author first noticed this effect when, as a boy, he spun a little cotton-spool windmill by the well-known "Little Hustler" motor. A toy motor when running at high speeds as they do, and sparking heavily at the brushes as they also do, gives off quite a bit of the form of oxygen gas which is commonly termed ozone. The gas can be detected by its odor. "Your nose knows." This is the most obvious test for the presence of ozone, namely its peculiar oniony odor.



Making ozone electrically, using an extemporized Leyden jar.

Ozone will discolor certain chemicals, among them being a mixture of potassium iodide and starch. Its action in this case is to set iodine free which with starch solution produces a bright blue color. The solutions should be rather weak to give good effect. A pinch of starch is shaken into a test tube one-quarter filled with a warm solution of potassium iodide. Into the suspension formed, strips of white filter paper are dipped, removed, dried and preserved in a tightly stoppered bottle. One of these strips, if moistened and exposed to the air near the brushes of a toy motor in operation, will turn blue if ozone is being formed by the sparking at the brushes. These potassium iodide-starch papers can be used as tests for ozone in any of the following experiments.

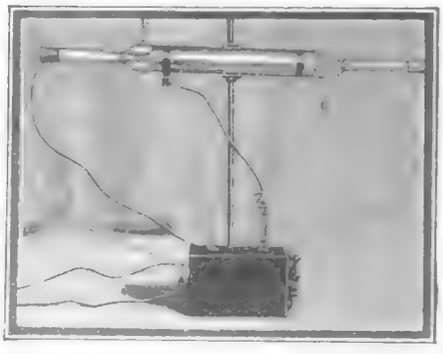
Another simple method of producing ozone is by the slow oxidation of phosphorus. Bits of phosphorus are placed in a bottle fitted with a stopper carrying two tubes, one protruding into the bottle and reaching it nearly to the bottom. A small quantity of water, just enough to half cover the phosphorus lumps, is placed in the bottle. At the end of the day the air within the bottle will be ozonized, and by passing a stream of water into the bottle through the longer tube, the ozone-laden stream of air will issue from the shorter piece of tubing. A strip of moistened iodide of starch paper hung at the exit will become quickly discolored if ozone is present.

Making ozone by slow oxidation of phosphorus.

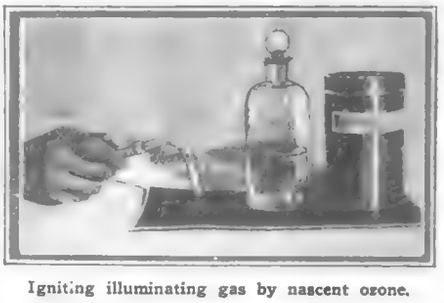
A simple way of producing ozone electrically is to utilize a simple home-made glass dielectric condenser made from a glass tumbler coated on the inside and the outside with tinfoil, the foils not touching each other. It is a sort of simplified Leyden jar. The inner foil should be connected with one secondary terminal of a spark coil and the outer coating of the glass tumbler connected to the remaining secondary terminal of the spark coil. A Ford coil can be used. On operating the coil, a silent or brush discharge will take place through the glass between the foils, and some of the oxygen of the air between the glass and the foils will be converted into ozone. It can be recognized by its odor or by the iodide of starch paper. It is best to lay the inside foil within the tumbler and not affix it snugly to the glass.

Another method for the production of ozone is brought about by a slightly different apparatus. Two bare copper wires are connected to the secondary of a spark coil. The wires run the length of a glass tube on the inside, but are not permitted to come in contact with each other in any way. A stream of air passed through the tube becomes ozonized when the coil is operated.

A better method for producing ozone is carried out with an apparatus shown in one of the photographs. A coating of tin or copper foil is wrapped around the glass jacket of a Leibig condenser, which has a straight inner tube. One end of the condenser, preferably the delivery end, is closed with a cork. The other end of the condenser is fitted with a cork which carries a wire for contact with a dilute solution of salt water, sulphuric acid, or any other electrolyte which is poured into the inner tube of the condenser. The cork which carries the electrode is inserted and the electrode connected to one side of the secondary of a small spark coil. The tinfoil or copper foil is connected with the remaining electrode. A stream of oxygen or of air is then passed through the outer casing or tube of the condenser, entering by one of the side tubes. If the coil is operated, a stream of ozonized air will be delivered from the other side tube.



A Liebig condenser is used as a basis for an ozone apparatus.

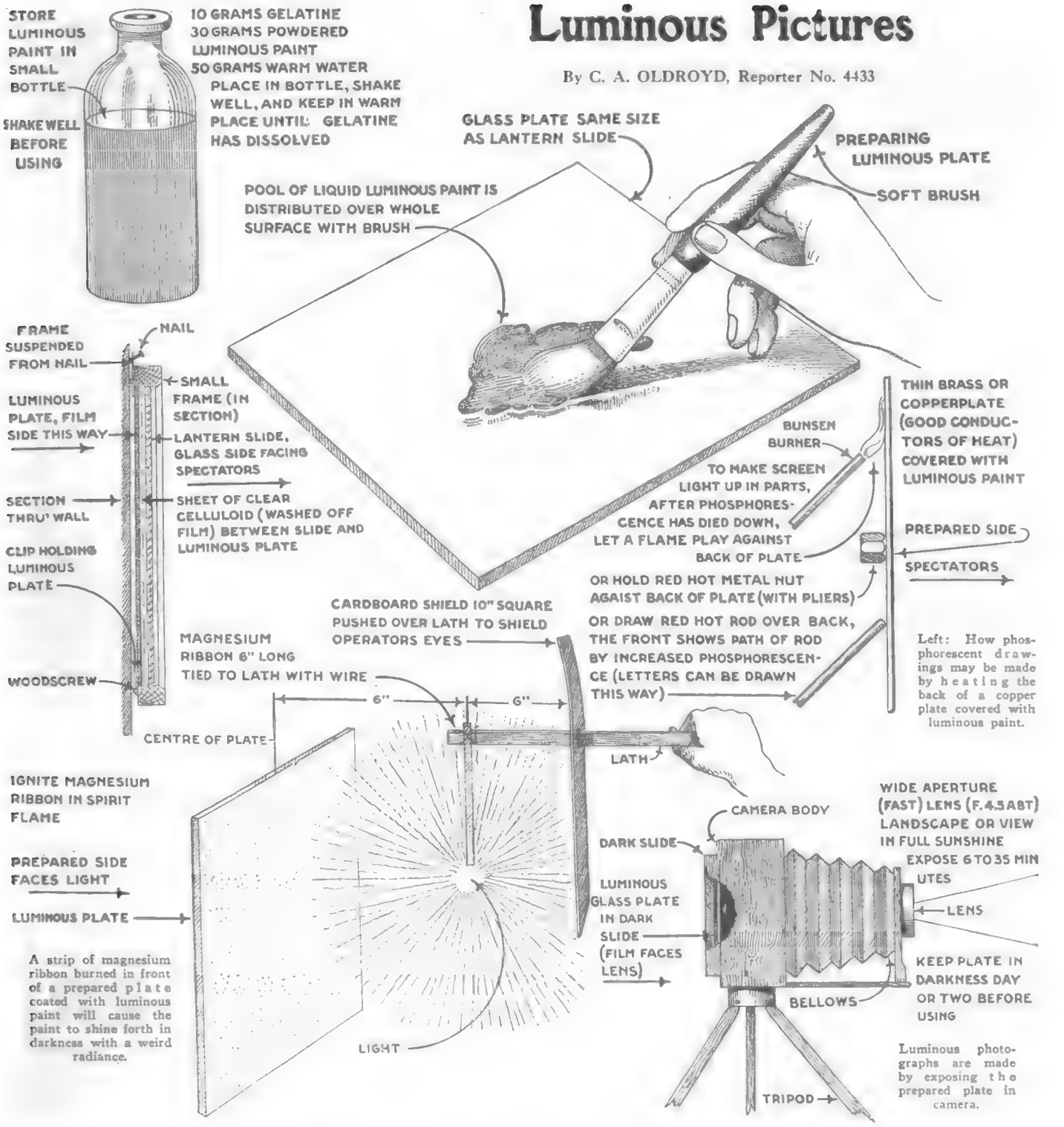


Igniting illuminating gas by nascent ozone.

An interesting experiment with ozone can be performed which produces much amusement. Several crystals of potassium permanganate are moistened with water and upon the little pile a drop or two of strong sulphuric acid is allowed to fall. A stream of illuminating gas directed against the pile of crystals will immediately become ignited, and burn with a white flame.

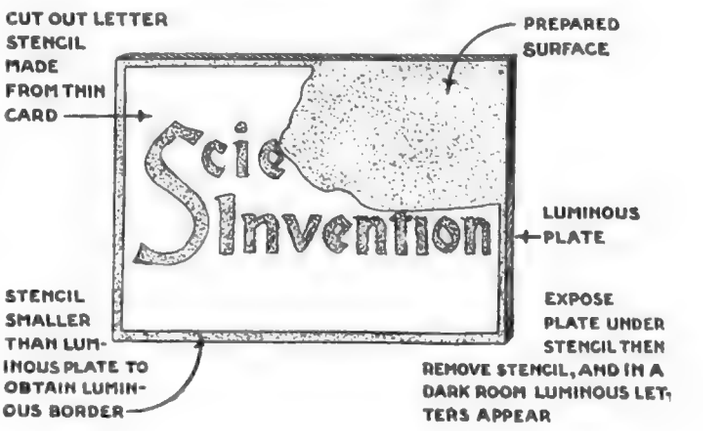
Luminous Pictures

By C. A. OLDROYD, Reporter No. 4433


STORE LUMINOUS PAINT IN SMALL BOTTLE
SHAKE WELL BEFORE USING
10 GRAMS GELATINE
30 GRAMS POWDERED LUMINOUS PAINT
50 GRAMS WARM WATER
PLACE IN BOTTLE, SHAKE WELL, AND KEEP IN WARM PLACE UNTIL GELATINE HAS DISSOLVED
GLASS PLATE SAME SIZE AS LANTERN SLIDE
PREPARING LUMINOUS PLATE
SOFT BRUSH
POOL OF LIQUID LUMINOUS PAINT IS DISTRIBUTED OVER WHOLE SURFACE WITH BRUSH
FRAME SUSPENDED FROM NAIL
NAIL
SMALL FRAME (IN SECTION)
LUMINOUS PLATE, FILM SIDE THIS WAY
LANTERN SLIDE, GLASS SIDE FACING SPECTATORS
SECTION THRU' WALL
SHEET OF CLEAR CELLULOID (WASHED OFF FILM) BETWEEN SLIDE AND LUMINOUS PLATE
CLIP HOLDING LUMINOUS PLATE
WOODSCREW
THIN BRASS OR COPPERPLATE (GOOD CONDUCTORS OF HEAT) COVERED WITH LUMINOUS PAINT
BUNSEN BURNER
TO MAKE SCREEN LIGHT UP IN PARTS, AFTER PHOSPHORESCENCE HAS DIED DOWN, LET A FLAME PLAY AGAINST BACK OF PLATE
OR HOLD RED HOT METAL NUT AGAIST BACK OF PLATE (WITH PLIERS)
OR DRAW RED HOT ROD OVER BACK, THE FRONT SHOWS PATH OF ROD BY INCREASED PHOSPHORESCENCE (LETTERS CAN BE DRAWN THIS WAY)
PREPARED SIDE
SPECTATORS
Left: How phosphorescent drawings may be made by heating the back of a copper plate covered with luminous paint.
CARDBOARD SHIELD 10" SQUARE PUSHED OVER LATH TO SHIELD OPERATORS EYES
MAGNESIUM RIBBON 6" LONG TIED TO LATH WITH WIRE
6"
6"
CENTRE OF PLATE
LATH
IGNITE MAGNESIUM RIBBON IN SPIRIT FLAME
PREPARED SIDE FACES LIGHT
LUMINOUS PLATE
A strip of magnesium ribbon burned in front of a prepared plate coated with luminous paint will cause the paint to shine forth in darkness with a weird radiance.
LIGHT
CAMERA BODY
WIDE APERTURE (FAST) LENS (F.4.5 ABT) LANDSCAPE OR VIEW IN FULL SUNSHINE EXPOSE 6 TO 35 MINUTES
DARK SLIDE
LUMINOUS GLASS PLATE IN DARK SLIDE (FILM FACES LENS)
LENS
KEEP PLATE IN DARKNESS DAY OR TWO BEFORE USING
BELLOWS
TRIPOD
Luminous photographs are made by exposing the prepared plate in camera.

LUMINOUS paint can be purchased or it can be made up of *phosphorescent* calcium sulphide dissolved in the proportions shown in the upper left-hand corner of this page. The paint so prepared should be distributed smoothly over the surface of a glass plate and allowed to dry. Several thin layers are better than one thick coat. The plate so prepared is placed in a frame together with a lantern slide or other positive transparency, the frame being conveniently made as shown. The luminous plate should be exposed to sunlight or to burning magnesium ribbon either before or after it is placed in the frame. Inspection of the assembled photograph will show a very weird effect. Luminous stencils can be made by placing a cut-out sheet over a luminous plate as at the right.

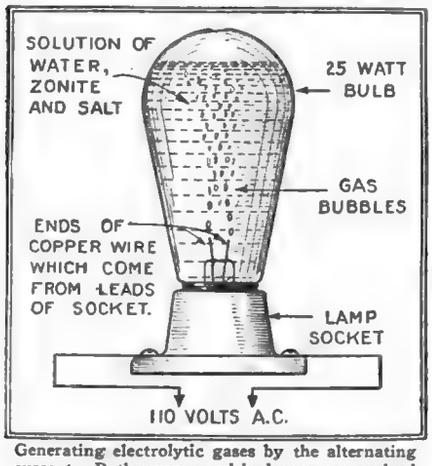
Actual luminous photographs can be made by exposing a prepared luminous plate in a camera in just the same way as a photographic plate is normally exposed. Follow the directions given for exposure, experimenting until the correct time has been determined. Before exposure, the prepared plate should be kept in darkness and should not be exposed to light for a day or two before use. Variations are to expose luminous plate to light through stencil or through negative, remove the covering and the designs will stand out in luminous relief.


CUT OUT LETTER STENCIL MADE FROM THIN CARD
PREPARED SURFACE
Scie Invention
LUMINOUS PLATE
STENCIL SMALLER THAN LUMINOUS PLATE TO OBTAIN LUMINOUS BORDER
EXPOSE PLATE UNDER STENCIL THEN REMOVE STENCIL, AND IN A DARK ROOM LUMINOUS LETTERS APPEAR

Electrolyzing by Alternating Currents

By Wesley Cole

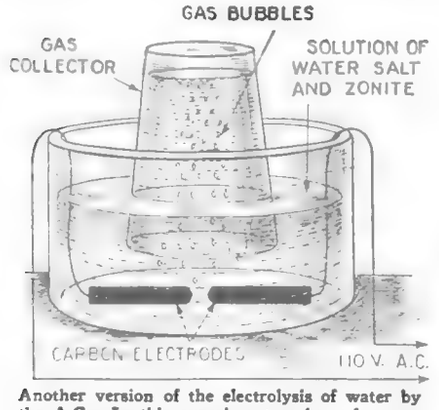
IN preparing a solution of water, salt, and zonite (a hypertonic electrolized solution of sodium oxychloride), and passing a 60-cycle alternating current at 100 volts


SOLUTION OF WATER, ZONITE AND SALT
25 WATT BULB
GAS BUBBLES
ENDS OF COPPER WIRE WHICH COME FROM LEADS OF SOCKET.
LAMP SOCKET
110 VOLTS A.C.

Generating electrolytic gases by the alternating current. Both oxygen and hydrogen are evolved from each of the two terminals. An old lamp bulb is used in this experiment.

through the solution, the hydrogen and oxygen, which result from the decomposition of the water, will be polarized and will pass to the electrodes, and will lose their charge as soon as they reach them. The electrodes are neither anodes nor cathodes, due to the change in polarity of the current. The gases therefore do not form into separate columns of hydrogen and oxygen, but bubble off together.

When the solution is first placed in the gas-collecting apparatus, it is colorless, but after a while there comes a brown sediment due to the sodium. This gradually combines with the water to form a very weak solution of lye.



Another version of the electrolysis of water by the A.C. In this experiment carbons from an old battery form the electrodes. If we collect the gas in a test tube and ignite it, it will explode violently.

The following equations represent the reaction:

(a) $H_2O + NaCl + NaOcl \rightarrow Cl_2 + H_2 + O_2 + 2Na$ (These two *atoms* of sodium combine with hot *molecules* of water).

(b) $2Na + 2HaO \rightarrow 2NaOH + H_2$

In equation (a) the water furnishes the two hydrogen ions (there are two atoms of a gaseous element such as hydrogen, oxygen and chlorine which become molecules of the element gas and pass off).

The salt and zonite furnish respectively one ion of chlorine and one of sodium which when they reach one of the electrodes lose their charge and become atoms. The chlorine passes off as gas while the sodium remains for the present in the solution. The difference between, for instance, Cl_2 and 2Cl is that 2Cl is just two atoms of chlorine while Cl_2 is a molecule and may pass off as a gas. The water and the zonite each form an oxygen ion which becomes two atoms of oxygen on touching an electrode and then after they unite with each other, they form a molecule of oxygen gas which passes off. All the products formed are gases except sodium of which there are two atoms. These two atoms of sodium combine with two molecules of water to form two molecules of a weak lye solution.

The preceding information may seem technical but it will help those who are used to definite formulas. There is nothing more which can be explained to the chemist. The following illustration serves to make it clear:

A small electric lamp bulb which has been burnt out or one with the filament broken is necessary. Knock the tip off. Air will rush in. One may easily break the glass filament support rod in the bulb. The bulb should be entirely clear of pieces of filament or fragments of glass.

Then make a solution of salt, zonite, and water of which the proportions may vary. Fill the prepared bulb with this solution, screw the bulb into a socket in such a position that the bulb will point to the ceiling. Send through 110 volts. It is advisable to have a 25-ampere fuse or possibly a thirty-ampere fuse in the fuse box. One will see bubbles rise to the tip. The gas will escape through the hole in the top of the bulb. After current has been going for about two minutes steady, feel the bulb. It is warm. An illustration is pictured opposite.

The escaping gas can be easily collected by natural means of which I will not attempt to explain here. The youthful experimenter can work on this which will prove profitable.

A Puzzle Lamp Circuit

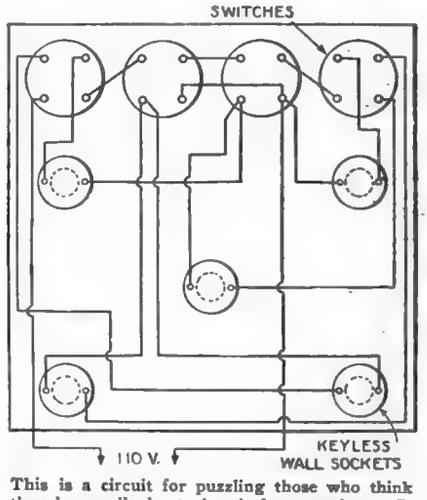
By Wm. B. Taylor

THE interesting combination circuit shown above has been used for making money at a fair, letting people try to light the temple light without lighting any of the others. The description follows:

Take a square box about 14″x14″x5″ deep with four 3-way switches and 5 sockets, you can connect them as shown in diagram, without any short circuit. By so doing you can obtain a numerous lot of combinations. You can have one light lit at a time, 2 lights in series, 3 lights in series, 4 lights in series, 1 light full with 3 in series and different other combinations. The center light is supposed to be red and this is the puzzle, to have the center light lit when the other 4 are off.

I have made this little wrinkle myself, and have been asked for the loan of it on several occasions, for such as Garden Parties, and sales of work, in different halls of this town. In one case in particular this wrinkle cleared $15.00 in one night, at 5 tries for 5 cents and the center light was lit once by one fortunate person for the night. There is only one way that the center light can be lit and if you will trace the wiring you will see how it can be done.

This diagram is drawn looking into the box, seeing only the bottom of back of switches and sockets. By turning the box



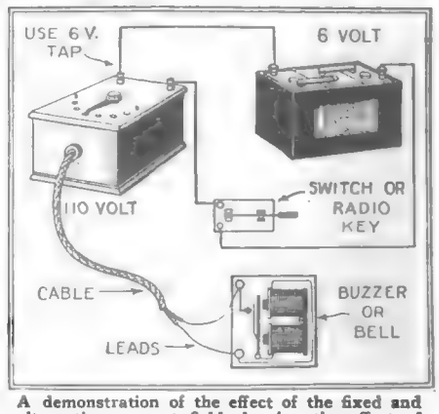
This is a circuit for puzzling those who think they know all about electrical connections. It can be used with remunerative results at a charity fair.

right side up the switch and sockets will be exposed ready for use.

Alternating Current Experiment

By Fred Ebel

AN interesting and at the same time highly instructive experiment is illustrated above. An ordinary step down transformer 6-volt battery, and a switch or radio key is all the apparatus required.



A demonstration of the effect of the fixed and alternating current field showing the effect of changing lines of force.

Since we wish to obtain A.C. we must change the current or intermittently interrupt it. The latter is executed by alternately opening and closing the key or switch. This makes the magnetic field in the transformer build up and collapse, a condition which results in an alternating E.M.F.

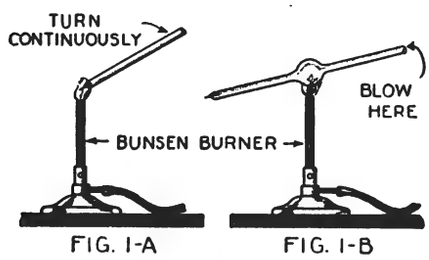
Every time the key is depressed and released the buzzer works. However, if the key is kept down the buzzer will not work since there are no changing lines of force.

If one cares for visible proof a 6-volt auto lamp may be substituted for the buzzer.

Wehnelt Interrupter

By PAUL LINDHOLM

A WEHNELT interrupter, if made as explained, in the following article will give a much longer and hotter spark at the secondary of an induction coil than would be obtained from a battery.



Making the tube with platinum sealed into its end to form one of the electrodes of the Wehnelt interrupter.

The most necessary parts for a Wehnelt interrupter are:

1 glass jar approximately 4" wide, 6" high
1 lead plate approximately 4½"x1½"x1/6"
1 glass tube ¼" wide, the length depending upon height of jar
1 piece of platinum wire No. 20 or 24 B&S gauge ½" long
A little mercury and some sulphuric acid.

Cut a piece of wood or hard rubber big enough to cover the top of the jar leaving about a half-inch all around extending beyond the jar. On the cover is mounted the lead plate and glass tube as shown in Fig. 2. Put a hole in the center for ventilation.

In sealing the platinum wire into the end of the glass tube, put the end of the glass tube over a Bunsen flame and keep turning it till it comes to a point. Just before it is entirely closed, insert the platinum wire, leaving a small portion of it extending out as illustrated in Fig. 1a. Keep turning it till the glass has melted around the platinum.

In mounting the glass tube have the length of the tube down to about the end of the lead plate. Most likely the hole you have drilled for the tube to pass through the lead plate was too small or just a little bit too large, which makes the glass tube slip down to the bottom of the jar. A remedy for this, is to blow a bulb on the tube to fix the positions you want the tube to be held at. Hold the glass tube over the Bunsen flame and as soon as glass becomes a little soft blow into it till it forms a bulb as shown in Fig. 1B. Put the glass tube back in the cover and fill it half full of mercury and insert a heavy wire into the mercury to make a contact. Be sure to have the lower platinum point extend up in the glass tube far enough to make contact with the mercury. Put a heavy wire on the binding post for convenience.

Now we are ready to prepare the electrolyte, a solution of water and sulphuric acid. To begin with have a very weak solution and gradually add acid till proper results have been obtained. The interrupter is now ready for its final assembly. Before putting lead and plate and glass tube in the electrolyte it is well to put some paraffin around the under side of the cover and around the edge of the jar to prevent acid from creeping up over the edge of the jar.

The interrupter is now ready for use. Connect in series with 110 volts and an induction coil, Fig. 2. Be sure to screw down the vibrator of the coil before starting because the current passed through the coil is

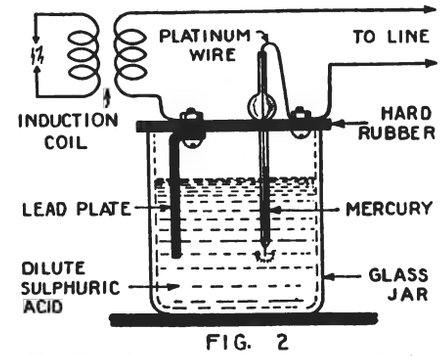


FIG. 2

The Wehnelt apparatus set up and ready for use. It is a very interesting apparatus and the experiment is quite instructive. Formation of gas bubbles effects the make and break.

rather heavy and might damage the contact points.

A Wehnelt interrupter operates as follows: When a current flows from the platinum electrode to the lead plate bubbles of gas are generated at the platinum electrode, these gas bubbles prevent the flow of current. The bubbles are then absorbed by electrolytic action, and the flow of current once more starts. This is continually repeated so long as current passes.

Taking the Resistance Out of Parallel Problems

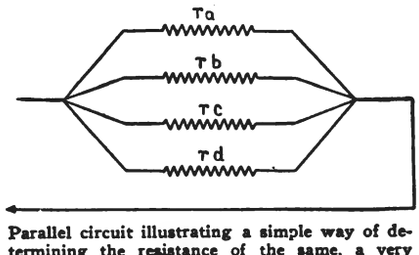
By CLARENCE SWANSON

THE method for finding the joint resistance of devices connected in parallel as given in textbooks, is known as the Reciprocal of the Reciprocal, or the Reciprocal of the Conductivities method. At any rate a sort of beating-around-the-bush route. An illustration of which follows:

Let R be the total resistance

$$\text{Then } R = \frac{\frac{1}{\frac{1}{ra}+\frac{1}{rb}+\frac{1}{rc}+\frac{1}{rd}}}{} = \frac{\frac{1}{\frac{1}{3}+\frac{1}{8}+\frac{1}{4}+\frac{1}{16}}}{} =$$

$$\frac{\frac{1}{\frac{16}{48}+\frac{6}{48}+\frac{12}{48}+\frac{3}{48}}}{} = \frac{\frac{1}{\frac{37}{48}}}{}$$



Parallel circuit illustrating a simple way of determining the resistance of the same, a very ingenious simplified calculation.

Cheer up, boys, she's almost cornered! the reciprocal $\frac{48}{37}$ gives 1 $\frac{11}{37}$ ohms

But work your next prob. this way.

Assume a voltage, any old voltage, say 48, which seems familiar at least. Then, according to old $I = \frac{E}{R}$, ra uses 16 amps

rb	"	6 "
rc	"	12 "
rd	"	3 "
Total amps		37

The joint resistance is then $R = \frac{E}{I}$ or $R = \frac{48}{37} = 1\ \frac{11}{37}$ total resistance.

Slide Wire Wheatstone Bridge

By MICHAEL H. TAYLOR

THE drawing shows a simply constructed slide wire bridge used to determine resistances. The slide wire bridge is interesting from the point of view of simplicity and of demonstrativeness.

The material needed is one pine board 36 inches long, 8 inches wide, ⅞ inch thick. Three strips of brass, one strip 36 inches long, two strips each 6 inches long, 1 inch wide, and ⅛ inch thick, and 40 inches of No. 14 German silver resistance wire and a known resistance.

First the baseboard should be shellacked and sandpapered several times before putting on the final coat.

The 36-inch strip of brass is fastened one inch from the edge of the board and 4 inches from each end. The 6-inch pieces are fastened at the ends with their centers exactly 1 meter apart (39.37 inches).

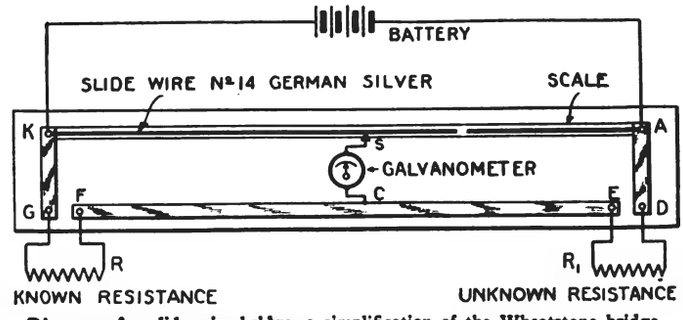


Diagram of a slide wire bridge, a simplification of the Wheatstone bridge and a particularly good demonstration of its principles.

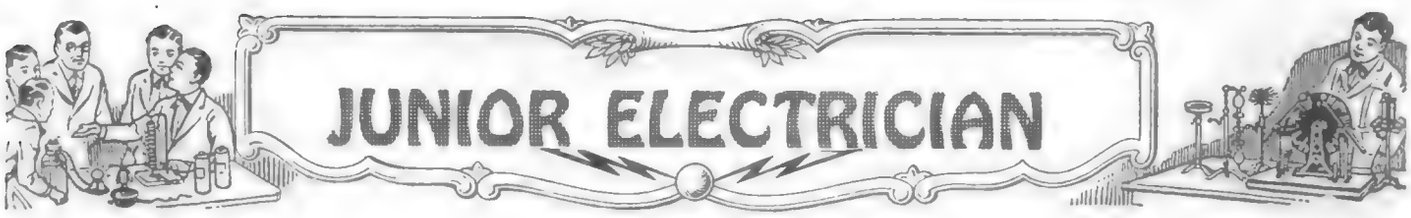
Binding posts are soldered at the points A, D, E, F, G, K.

One end of the galvanometer connects with the point C and the other end with the slider marked S.

For the scale a piece of paper 1 inch wide and 40 inches long with mark in ⅛ inch apart is fastened under the slide wire.

In use after connecting the unknown resistance the slide is moved until the galvanometer needle stands at zero. The proportional lengths of the parts of the strip on each side of the slider gives the ratio between the known and unknown resistance.

It is an admirable exposition of the principle of the bridge.



How to Make an Electric Motor

By HAROLD JACKSON

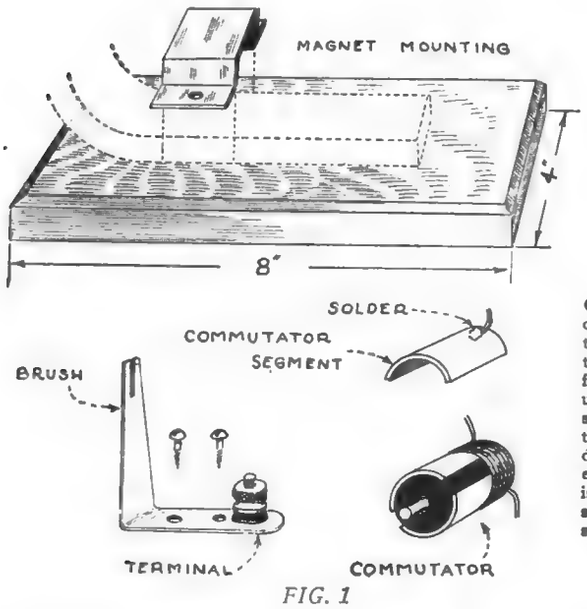


FIG. 1

On the left are shown various parts of an electric motor, and the construction of the two-part commutator is further explained in the figure directly above. The shaft of the motor passes through the two spacing disks. On the right a general elevation of the motor is given and the peculiarly shaped armature core is shown in Fig. 2, with one of the bearing supports.

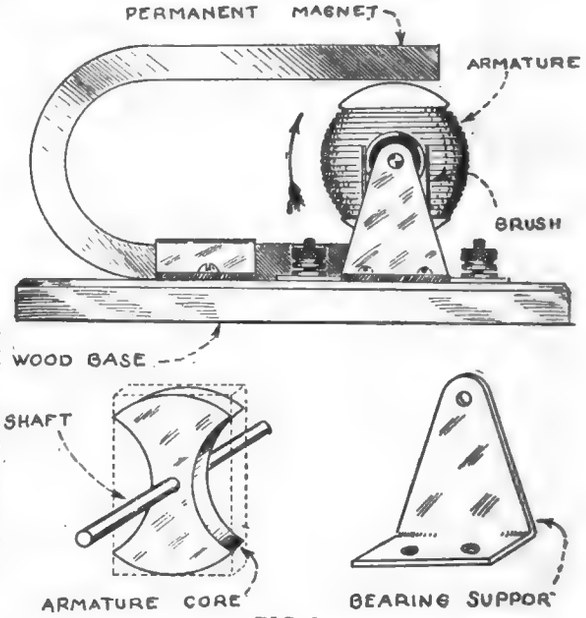


FIG. 2

I THINK that every boy has a desire to make an engine of some kind. I made several when I was younger and I am going to tell you how I made my most successful one. This little motor is simple in construction and no special tools are needed.

The base of this motor is a piece of board eight inches long and four inches wide. A permanent magnet taken from an old magneto is mounted on this board with a strap iron clip as shown in the illustrations. The magnet furnishes the field of the motor and takes no energy from the battery as does the field of a motor where the field flux is furnished by an electro-magnet.

The next part to make is the armature core. This is made of a piece of soft iron a half an inch thick and is filed into the shape shown in Fig. 2. A three-sixteenth-inch hole is drilled in the center for the shaft. The shaft is about four and a half inches long. The armature core is soldered in place at the center of the shaft. Two bearing supports are made of strap iron in the shape shown in Fig. 2. These are just the right height to support the armature midway between the poles of the magnet. Paper shims can be used under the supports if necessary to make them the right height.

The commutator is made as shown in Fig. 1. It consists of two segments cut from a piece of brass pipe which are bound with stout cord, to a small pulley-like core which is made of wood. The hole in this core should be a tight fit for the shaft.

The armature is wound before the commutator is driven on. The winding consists of many turns of No. 18 bell wire. About a half a pound will be plenty. The wire is wound on until the notches are full. The armature will look something like a ball. The commutator is driven on and the ends of the winding are soldered to the commutator segments, one end to each segment. The commutator is placed on the shaft so that the line between the segments is about forty-five degrees in advance of the center line of the armature core.

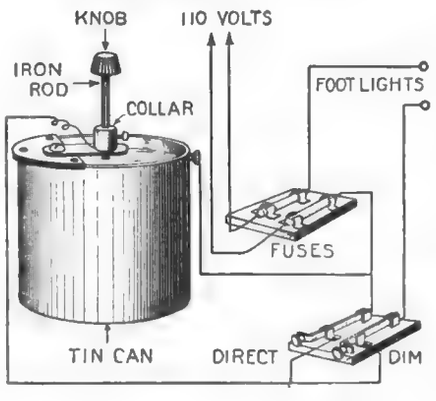
The armature is now ready to be mounted in its bearings between the poles of the magnet. End play is prevented by soldering small wire rings around the shaft just inside the bearings. These will hold the armature in the center.

The next and last things to make are the brushes. These are made of springy strips of brass, bent into an "L" shape, with an old battery binding post soldered to one end as shown in Fig. 1. Two brushes are required. They are secured to the wood base with two small wood screws. The brushes are located so that their upper end bears rather firmly against the commutator. Be sure that the brushes do not touch the bearing support. This would cause a short circuit.

Footlights Dimmer for Amateur Theatricals

By NORMAN O. WILSON

I HAVE found the apparatus shown in the accompanying diagram a dependable dimmer for the dozen or so footlights of the average amateur stage. The variable resistance unit, was made from a standard four-pound jam tin 5" dia. by 4½" deep. A binding-post was connected directly to the side of the tin. The moveable electrode was an iron rod about ¼" in diameter with an insulating knob at one end (mine was the knob of an old-fashioned two-piece dial) so that it could be raised or lowered with the hand. This rod moved up and down smoothly through a collar which had a thumbscrew in it so that the rod might be held in any position, and the whole was held rigidly in place by a piece of insulating material bolted to the rim of the tin. Contact to the rod was made through a flexible lead. The dim-direct switch was made by taking apart a d.p.s.t. switch and using the arms separately. Bakelite top binding-posts made excellent insulated knobs for the arms. Common salt solution was used as the resistance in the tin. The correct amount was found by experiment to be about a teaspoonful. In connection with the fuses it is well to remember that the current drawn by the lights is equal to the sum of the wattages divided by the voltage, and that the maximum current allowed for should not be above the carrying capacity of the supply wires.



This is a practical apparatus for dimming the footlights in amateur theatricals. An adjustable liquid resistance does the work.

Small Storage Cells

By A. E. UNDERWOOD, Farnworth, Lancashire

NOW that so many uses are to be found for small accumulators, it is an opportune moment to give an account of how these useful but sometimes expensive accessories can be made at home at a small cost. There is, however, one point which requires particular note, and that is, the maker of the accumulators in question must have access to a direct current of some description, such as a D.C. lighting supply, the reason being that the first "formation" of the plates is rather a slow job and quite beyond the primary battery. If carefully made, the accumulators possess a good life. To start with, the size of the plates can be decided by the containers which are to hold them, and any rectangular glass jars or old celluloid cases can be used for the purpose. Having decided on the size of the plate, the first job is to make a mould for the grid. Now, there are many ways of making a mould for this job, but after a trial of many types, the one described gave the best *grids*.

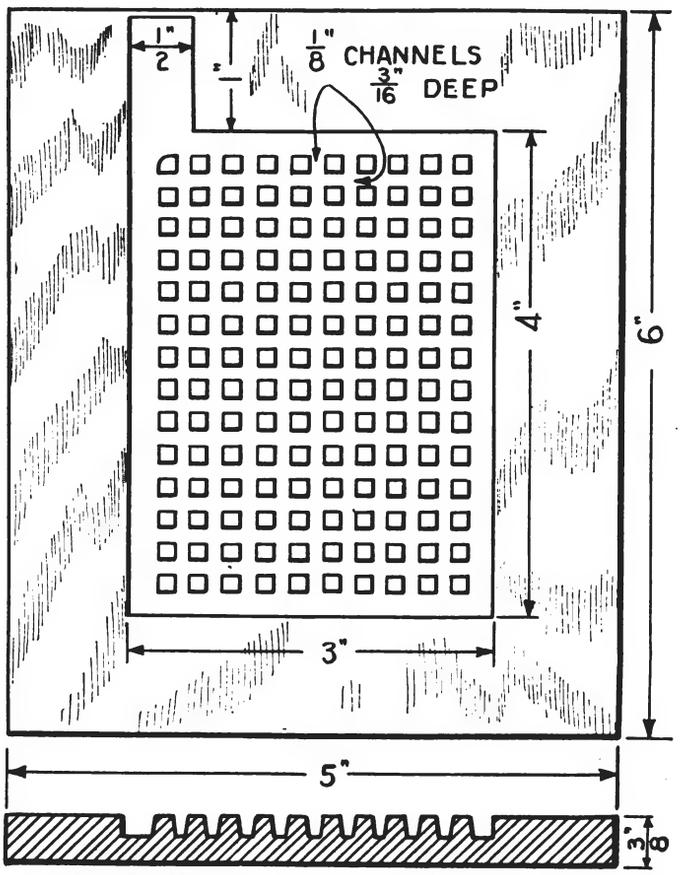
A piece of sheet brass about ⅜ in. thick and 2 in. overall larger than the grid is obtained, and I think it will be as well if we fix on some definite size, say, a 4-in. by 3-in. grid; we shall therefore require a piece of brass 6 in. by 5 in. by ⅜ in. In this brass the pattern of the grid is cut, and the quality of the best grid will prove to the maker how skilful he is with saw, chisel and file. The type of grid favored by the writer is depicted at right, and gave very satisfactory results.

As is generally known, the lead accumulator undergoes continual expansion and contraction during its stages of charge and discharge, and for this reason large masses of active paste are to be avoided. With this point in mind, we make a fine mesh grid as shown. The channels are cut with ⅛-in. and 3/16-in. chisels to a uniform depth of 3/16 in. and should be very slightly tapered towards the bottom. It will be noted that the lug side is ¼ in. by 3/16 in. whilst the front limb is 3/16 in. by 3/16 in. So also are the top and bottom limb. The lug is best placed at one end and can safely be made ½ in. wide. The best way to mould the grid is to put the brass mould on a small tripod with a Bunsen burner under it. A piece of mixture of lead 95 parts and antimony 5 parts is laid upon the mould which, when hot enough, will cause the mixture to melt. The molten mixture should be distributed over the meshes of the mould and the surplus scraped off with a piece of smooth wood and the gas turned off.

After about two minutes the lead will have set, the mould then being placed in a bucket of cold water. By inserting a pen-knife blade under the lug end, the grid can be stripped from the brass mould. If the mould should cause the grid to stick badly in any place, it requires the taper increased a little at that point. When the mould is in proper form, it will be quite possible to make a grid in five minutes, so a little time is well spent at first getting the mould correct.

When the number of grids have been cast, with a few spares, they can be gone carefully over for cracks and trimmed with the point of a sharp pen-knife. It will be noted that no provision is made for holders, but this is not necessary in this type of accumulator.

The next process consists of filling in the grids with paste, and perhaps the following method will be new to a few. No red lead is used for the positive plates. All the grids are pasted on a sheet of glass with "litharge" and ammonium sulphate. The "litharge" should be carefully chosen and should be in powder form. Any "litharge" which is in the form of tiny flakes should be discarded. The ordinary commercial ammonium sulphate can be used, and is very cheap. A saturated solution of ammonium sulphate is used to make the "litharge" into a good stiff paste, and here lies the secret of success. The paste must not be hard and lumpy, or the plates will be poor, nor must it be to sloppy to work. It quickly sets up to a certain point, liberating copious doses of ammonia gas, so too much should not be made at one batch. Sufficient for three or four plates is easily worked.



The plates for this storage battery are cast in a brass mold and the writer says that the quality of the plates will show how good a workman the constructor was. While it seems to be a difficult piece of work to make one of the brass molds, it must be remembered that they are good for any number of the lead plates. The battery is of the pasted type and it will be found most satisfactory.

The grid is laid on the sheet of glass and the paste well pressed into the grid. It should then be *slid* off the glass, and *not* lifted, and the other side treated likewise. It will be found an easy method of finishing the plate after pasting to draw it once or twice on each side on the glass plate, as this method leaves the plate with a nice flat finish. Next it should be stood up to dry for at least eighteen hours in a dry room, but must *not* be hurried by outside heat. When all the plates are dry, they are ready for forming. Short pieces of lead fuse wire are twisted tightly round each lug, and the plates are now put into any old jam jar, preserve jars, celluloid cases, or anything that will hold two plates. They are next coupled up in series. A quantity of pure sulphuric acid, sp. gr. 1.84, should be obtained, and this must be diluted with pure water (either distilled or rain water) until it has a sp. gr. of 1.12.

This acid, when cool, is used to fill the containers up to the tops of the plates, and the current is immediately switched on. For the size of plate in question not more than one ampere should be passed through.

The process of forming is somewhat slow, but at the end of twelve hours the negative plates will be noticed to be developing very grey patches, and the positive plates will be changing to a chocolate brown. When this change is uniform all over both sides of the plates, the current can be switched off and the plates connected across a moderate resistance to discharge them. They should not be *quite* discharged, however, but the discharge should be stopped when the voltage of each cell is about .75. The plates should then be taken out of the acid and washed in three changes of water and dried.

Each complete cell of any number of plates is then assembled in the following manner: A negative plate is put on a flat surface; it is then covered with thin strips of wood shavings. The kind of wood is important. Such woods as pitch pine, which contain resin, etc., should not be used. A piece of good white pine is the best, and shavings about 1/16-in. thick are easily obtained.

Great care must be used in fixing the shavings so as to be sure that the next positive plate will not touch the negative one.

When the first negative plate is covered in this way, a positive plate is placed upon it. The positive plate is then covered in the same way and a negative placed upon that. Of course, all negative lugs are placed at one end, and all positive lugs at the other.

In this way the cell is built up, say eleven plates, five positive and six negative. The batch of plates are then carefully bound together with tape to enable them to have any shavings trimmed. This is best done with a pair of small snips. The lugs of each side are then burned together with a small blow-pipe, and the connecting terminal fixed at the same time. All that then remains to be done is to fix the cell in its container, fill with acid of 1.12 sp. gr., and charge slowly until the cell gases freely.

In the experiments of the writer, which spread over a number of years, it was established, amongst other things, that the wood insulation fixed between the plates in the manner described does not in any way diminish the output of the cell, while forming a compact block of plates, which makes it almost impossible to short-circuit through loose paste, and makes an admirable construction for withstanding vibration.

The wooden separators from discarded cells may be used instead of shavings; the idea of using the latter is to secure simplification.—*London Electricity.*

THE CONSTRUCTOR

How to Build Your Own Airplane

This Handsome Single Passenger Sport Plane of Proven Performance Has a Ceiling of 7,000 feet and a Speed of 100 Miles Per Hour with 30 H. P. Engine.

IT is with great pleasure that we introduce our readers herewith to the greatest of all sports today, that of flying. Thanks to the great advances made in the designing and building of easily constructed aircraft, Young America doubtless will soon be winging its way over the countryside. There are sufficient flying fields in most locations, so that if desired the man who builds or buys such a plane as the one described here, can take flying lessons and thus obtain a first hand knowledge of the "feel of the air." By practising with the plane and taxying over the field, allowing the plane to rise a short distance and then landing again, flying knowledge can be obtained at first hand. We recommend, however, that whenever possible, the services of a competent pilot be obtained in order that he inspect the machine before any flights are taken, to see that it is sufficiently strong in all of its parts, especially if the craft is home built. Also he will give you all the pointers you should know before ever trying to rise from the ground. This includes such instruction as always starting off or landing *into the wind*. We have not the space here to give a course in flying, and the people who sponsor this sport plane and who supply all the parts, engines, propellers, as well as the complete plane, ready to fly if so desired, also furnish at $5.00 a practical *home study course* in aeronautics. The complete blueprints, as furnished by the builders of this famous sport plane, cost $15.00, and orders will be filled by the publishers of this magazine without any extra charge above the prices quoted above.

The sport plane finished and ready to fly.

ENGINE AND SPEED DATA

This little sport plane is of very beautiful lines and has attained a speed of one hundred miles per hour, its usual maximum speed being rated at 90 M.P.H., with a cruising speed of 75 M.P.H. Its landing speed is 35 M.P.H., which is quite safe, all these speeds being obtained with the Anzani three-cylinder 30-35 H.P. engine. This engine will cost several hundred dollars, but it is one of the finest makes for aircraft that is available today. A cheaper engine is the Lawrence, 28 H. P., two-cylinder type, and this with propeller is worth $85.00. Quite a creditable performance can be obtained with this sport plane utilizing a common motorcycle engine. There are a number of other light airplane motors on the market, and of course these could be fitted without a great deal of trouble. To those interested in purchasing the complete plane with Anzani motor, it may be said that the price is about $1,500.00, and if the Lawrence 28 H. P. two-cylinder engine is substituted, the plane ready to fly will cost $1,200.00, while the plane built complete without any engine but with mounting for engine, costs $895.00.

This little sport plane is very economical, and will fly thirty-five miles per gallon of gasoline used. The flying range of this sport plane is 250 miles with one loading of fuel, and it can climb at the rate of 800 ft. per minute. It is interesting to note that the designers have figured on a factor of safety throughout of eleven, *i.e.*, each part of the plane, when properly constructed and assembled, is eleven times stronger than necessary to stand the given load and strain.

It will be seen by inspecting the drawings herewith that the span of the plane is 20 ft., which means that it can be stored in a very small hangar. The wings are covered with grade A linen, or airplane cloth; which should receive five coats of nitrate dope, and they are then finished with two coats of Valspar varnish. There are a number of books available in public libraries or from publishers which contain information on how to cover the wings and apply the nitrate dope, but the course mentioned above is strongly recommended if you have had no experience in building aircraft before. In the next installment, special drawings made by our own draftsman, will show just how to build the wings and cover them with the linen cloth. It is an interesting process, this covering of the wings, and the method of sewing the cloth to the ribs will be shown in the forthcoming drawings in the August number.

DETAILS OF CONSTRUCTION

There are many new features infused in this little craft and by the removal of seven bolts the plane may be dismantled and ready for crating or storage in less than 30 minutes. The entire tail unit is of welded steel tubing construction. The stabilizer is of symmetrical camber and detachable, while the rudder and the fin are built into the fuselage, so that there is a small fin exposed on the underside to which is attached the tail skid, this also being of steel and resting on the usual shock absorber cord.

The undercarriage is of steel tube construction with through axle. The struts are streamlined with bass wood 20"×4" wheels are used. Width of axle is 4½ ft. Wings—The webs of the ribs are bass wood with the usual lightening holes, while the capstrips are of spruce. Spars are of the routed I-beam sections, also of spruce and spliced in the center so that they form continuous spars through the whole span of the wing, with a dihedral of 4 degrees.

Each plane is built in one continuous panel from tip to tip. The upper plane has a cutaway at the center over the cockpit, and is fastened to the center N-struts with four bolts. The lower plane, which is a single panel, is fastened to the underside of fuselage with three bolts. The ailerons are on the lower plane only, and the aileron control wires run within the lower wing. The single I-struts on each side of the interplane bracing are of built-up spruce laminations. Landing wires are single, flying wires are double, all are 3/32 inch cable. Fuselage—The fuselage is of the girder type built of spruce, the longerons being of ash forward of cockpit. The cockpit has plenty of leg room for such a small machine. The rear end of the fuselage tapers off into a horizontal wedge, the whole being nicely streamlined with bass wood false work. The cowling is of 20 gauge aluminum.

DIMENSIONS

Span both wings, 20 ft.
Chord both wings, 34 in.
Gap between wings, 40 in.
Stagger, 15 in.
Length over all, 16 ft.
Height over all, 5 ft., 7 in.

WINGS

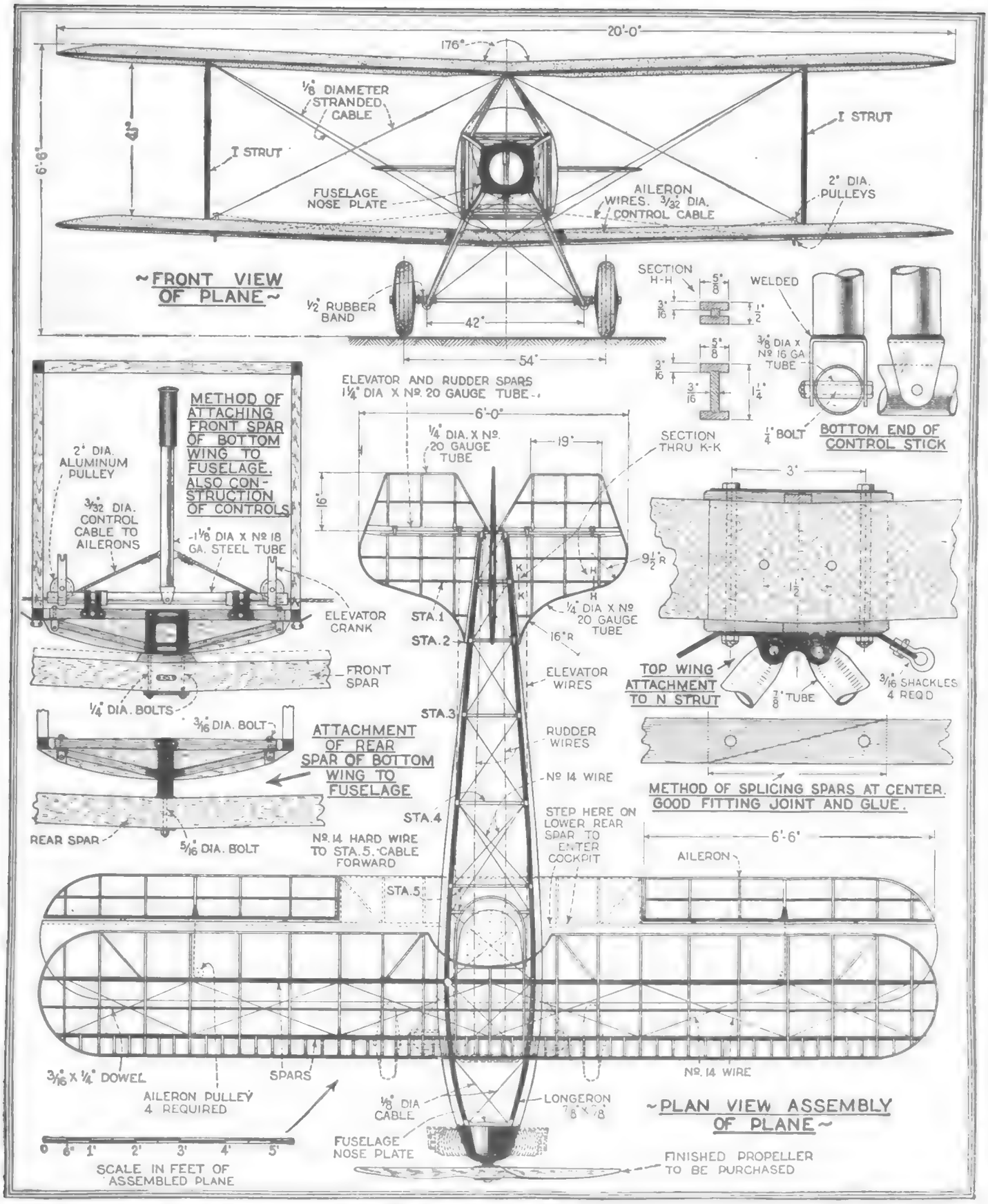
Wing curve, U. S. A. 27.
Total wing area, 108 sq. ft.
Angle of incidence, top wing, 1½ deg.
Angle of incidence, bottom wing, 0 deg.
Decalage, 1½ deg.
Dihedral both wings, 4 deg.

TAIL UNIT

Stabilizer area, 7½ sq. ft.
Elevator area, 5½ sq. ft.
Fin area, 3 sq. ft.
Rudder aera,, 3 sq. ft.
Aileron area, each 6 sq. ft.

(*Continued on page* 270)

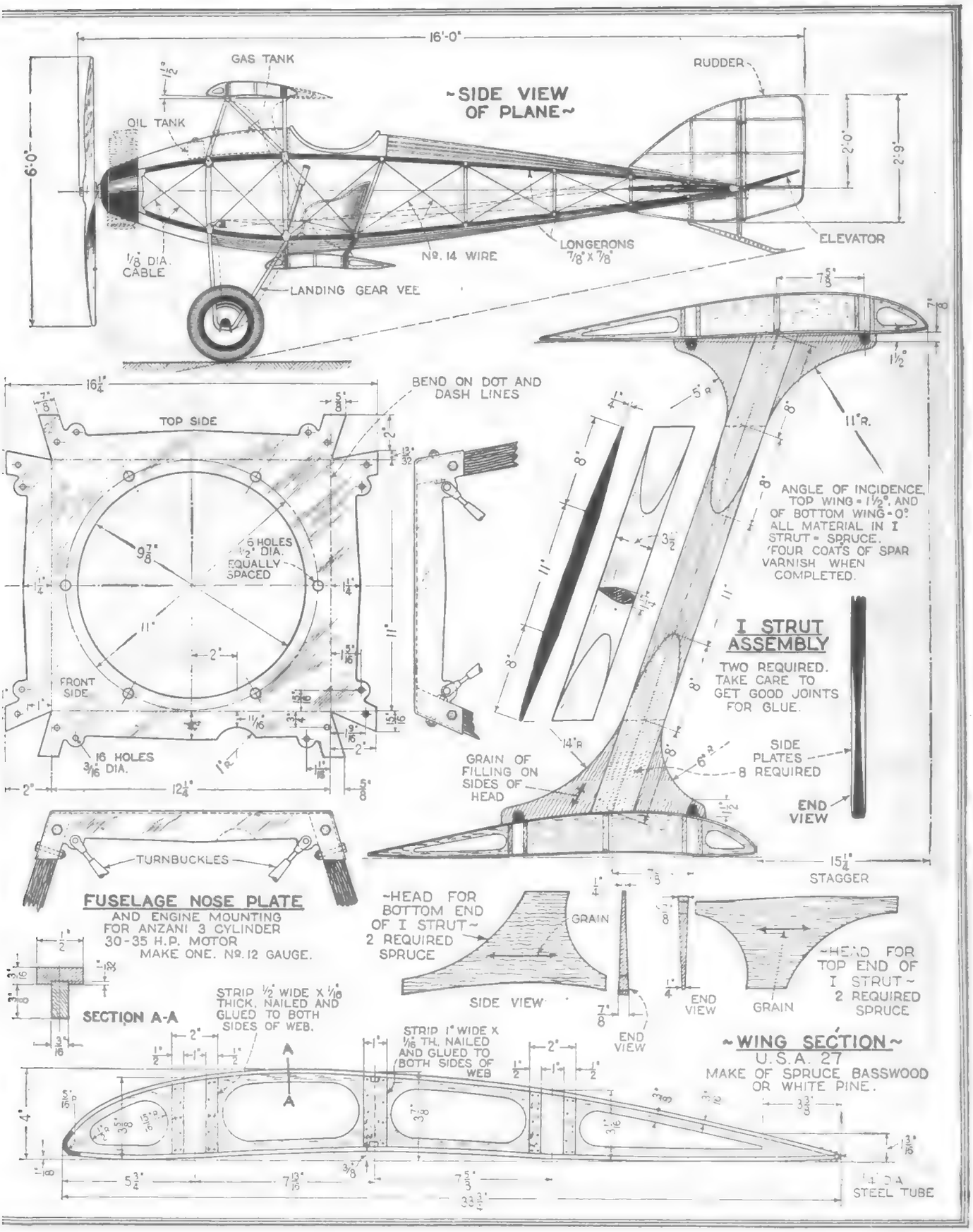
Construction Details of Sport Plane



THE drawing above shows in considerable detail top and front views of the single passenger sport plane described in the accompanying article. We are very happy to present this excellent design of commercial sport plane, many hundreds of which have been successfully built and flown, to the readers of SCIENCE AND INVENTION Magazine. This airplane can be flown with a motorcycle engine, but when the flyer is up in the air he will feel much more sure of himself, if he uses the Anzani motor recommended by the company who supply the parts of this plane to those who do not care to make their own. A three or four cylinder engine is much to be preferred as one of the prominent World War flyers explained to the Editors in a recent interview. The control features of this sport plane are very simple and in the August number, all these will be illustrated. A complete set of blueprints giving all details, are available from the Constructor Department at $15.00.

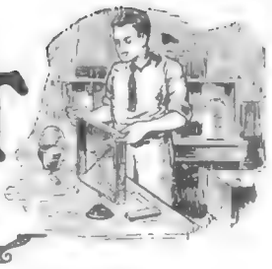
Construction Details of Sport Plane

(CONTINUED)

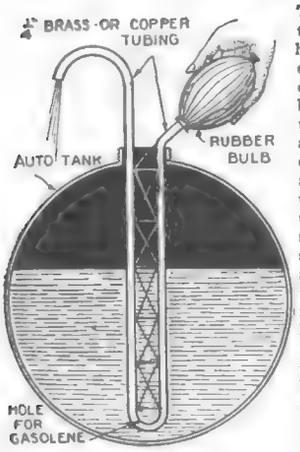

16'-0"
GAS TANK
RUDDER
~SIDE VIEW OF PLANE~
OIL TANK
6'-0"
2'-0"
2'-9"
1/8" DIA. CABLE
No. 14 WIRE
LONGERONS 7/8" X 7/8"
ELEVATOR
LANDING GEAR VEE
7 5/8"
1 1/2"
16 1/4"
BEND ON DOT AND DASH LINES
TOP SIDE
6 HOLES 1/2" DIA. EQUALLY SPACED
9 7/8"
FRONT SIDE
16 HOLES 3/16" DIA.
12 1/4"
11"R.
ANGLE OF INCIDENCE, TOP WING = 1 1/2°, AND OF BOTTOM WING = 0°. ALL MATERIAL IN I STRUT = SPRUCE. FOUR COATS OF SPAR VARNISH WHEN COMPLETED.
I STRUT ASSEMBLY
TWO REQUIRED. TAKE CARE TO GET GOOD JOINTS FOR GLUE.
SIDE PLATES 8 REQUIRED
END VIEW
14"R
GRAIN OF FILLING ON SIDES OF HEAD
15 1/4"
STAGGER
TURNBUCKLES
FUSELAGE NOSE PLATE
AND ENGINE MOUNTING FOR ANZANI 3 CYLINDER 30-35 H.P. MOTOR MAKE ONE. No. 12 GAUGE.
~HEAD FOR BOTTOM END OF I STRUT~ 2 REQUIRED SPRUCE
GRAIN
SIDE VIEW
END VIEW
~HEAD FOR TOP END OF I STRUT~ 2 REQUIRED SPRUCE
GRAIN
SECTION A-A
STRIP 1/2" WIDE X 1/16" THICK, NAILED AND GLUED TO BOTH SIDES OF WEB.
STRIP 1" WIDE X 1/16" TH. NAILED AND GLUED TO BOTH SIDES OF WEB
~WING SECTION~
U.S.A. 27
MAKE OF SPRUCE BASSWOOD OR WHITE PINE.
4"
5 3/4"
7 13/16"
33 3/4"
STEEL TUBE

IN the illustration herewith we have a good side view of the single passenger sport plane, together with details of the wing ribs, engine mounting plate, and the I strut, two of which are required between the upper and lower wings, as the photograph on the previous page shows. The axle supporting the landing wheels is resiliently mounted on the landing gear vees by wrapping ½-inch airplane rubber band around the bottom of the vee frames and the axle. The engine mounting plate can be made of steel and for other than the Anzani three cylinder 35 H. P. motor, a different design of mounting plate will have to be worked out. It is very important that this engine mount be securely guyed to the fuselage, and this is taken care of by the steel cables fitted with suitable turn-buckles, in the manner apparent from the drawings. The propeller cannot be successfully built by the average amateur airplane constructor, and is therefore, to be purchased. In the next installment the method of covering the wings will be shown in detail. The metal fuselage fittings should be purchased. Maker's name and address furnished on request.

HOW TO MAKE IT



GAS PUMP

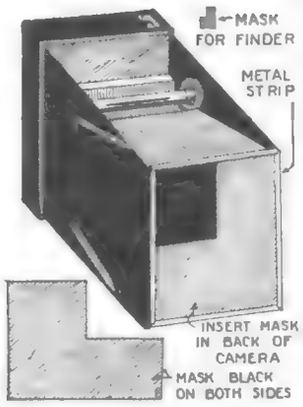


The diagram at the left shows how a small brass or copper tube coupled to a rubber bulb may be utilized to draw a small quantity of gasoline from an auto tank. The tube is bent as the illustration shows and a small hole drilled at the bottom of the bend. Air forces the gasoline out or the gas may be sucked into the bulb and then pumped out. — Donald Viall, Rep. No. 26778.

DOOR KNOB USES

In the illustration at the left is depicted a number of uses for metallic door knobs. Many times these articles are thrown away particularly when they begin to tarnish or look seedy. The bath sprayer or lawn sprinkler made from a door knob is punctured with a number of holes. Other uses are self apparent. — W. T. Markowski.

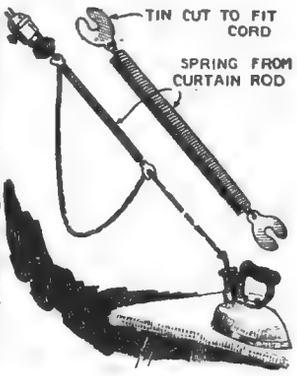
CAMERA IMPROVEMENT



A unique method for taking 24 exposures on an ordinary 6-exposure film is here shown. A black mask cut as illustrated is inserted into the camera and another similar mask is made for the finder. Six pictures are taken. The camera is then opened in a dark room, the film rewound and the masks changed to a new position. — M. J. Walker.

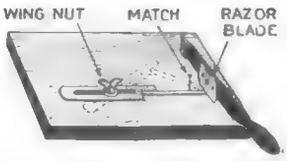
CORD ADJUSTER

If one will take the trouble to cut two small lugs of tin as indicated in the illustration and then fasten these to a curtain spring, a very serviceable adjuster for an electric appliance cord is made. This will take up the slack as the iron is moved back and forth across the board. —Grafton Cost, Rep. No. 18571.



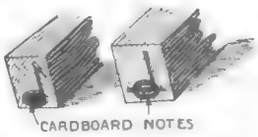
MATCH CUTTER

A simple method of making a cutter for matches is shown here. A razor blade serves as the cutting edge and a piece of wood clamped beneath a wing nut gives the fine adjustment.—Henry Frey.



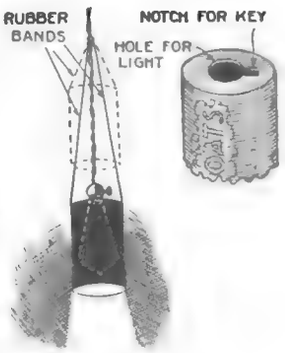
MUSIC PRINTER

Small blocks of wood have notes cut of cardboard glued to them. The cardboard absorbs sufficient ink to permit their being used as rubber stamps.—H. Vernon Rustin, Rep. No. 22326.

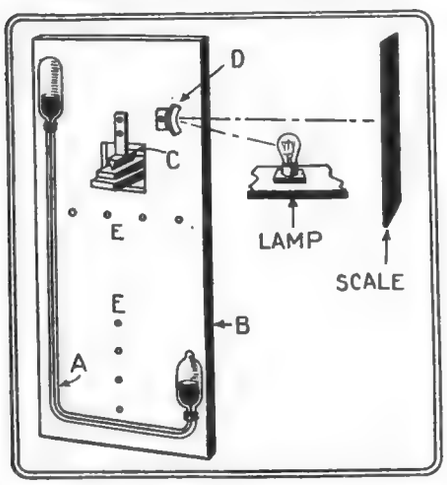


ADJUSTABLE DIRECTIVE LIGHT SHADE

An oatmeal box is first secured and a hole cut in the top so as to easily pass over a lamp socket. A notch is cut for the key of the socket. The box is then painted any desired color and suspended from the chain or cord by means of rubber-bands. When the shade is pulled down and slightly twisted, the light is directed downward.—John R. Malloy.

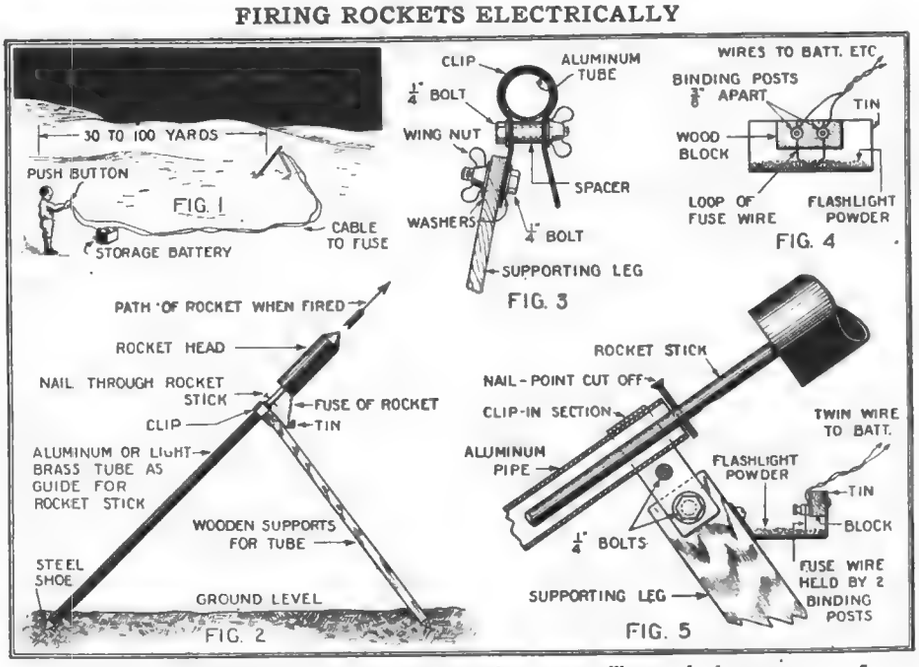


REGISTERING BAROMETER



A new balance registering barometer is illustrated in the accompanying sketch. A mercury barometer A is secured to a board B which rests by a knife-edge C on an extension projecting from the wall. A small concave mirror D is attached to the board. Changes in the air pressure cause the column of mercury to rise in one arm of the tube and fall in the other, tipping the board and consequently changing the position of a spot of light on a scale.

FIRING ROCKETS ELECTRICALLY

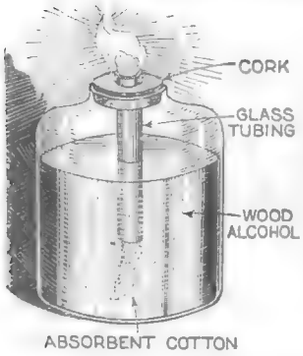


By means of a storage battery and the additional apparatus illustrated above, one can fire rockets when thirty to one hundred yards away from the scene of action. This action is ideal for lawn fetes and for children.—C. A. Oldroyd, Rep. No. 4433.

WRINKLES
RECIPES & FORMULAS

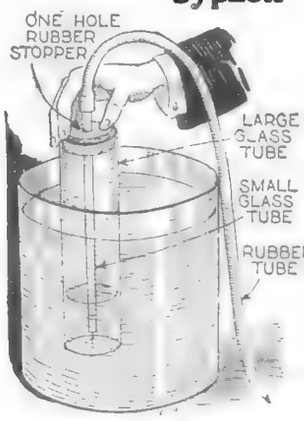
Edited by S. Gernsback

Alcohol Lamp



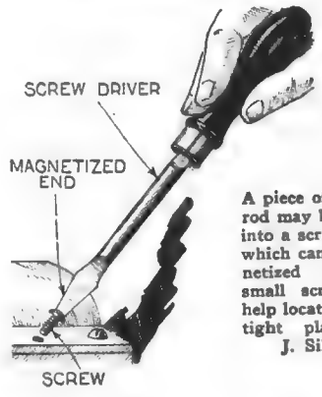
The illustration here shows how to make an economical alcohol lamp, using a wide mouth bottle, some absorbent cotton, a piece of glass tubing and a cork. — Jos. R. Goldburg.

Syphon



This syphon starts as soon as it is dipped into the solution. It consists of two glass tubes, placed as shown, the centre tube being raised until it functions properly.— Jack Riggin.

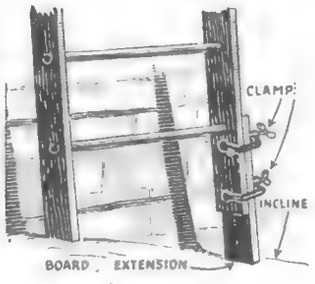
Magnetic Driver



A piece of old drill rod may be formed into a screw driver which can be magnetized to hold small screws and help locate them in tight places.—M. J. Silvert.

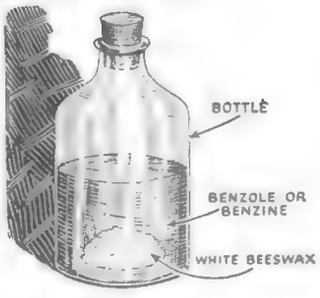
Leg Extension

When using the ladder on an incline, instead of piling boards under the short leg, an extension may be fastened to it by means of screw clamps, as shown.— Warren Scholl.



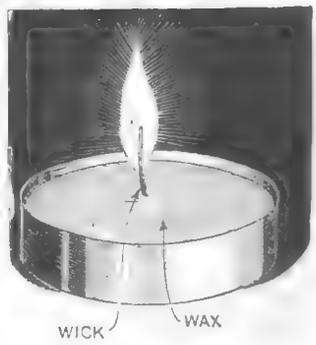
Rust Preventative

One ounce of bee's wax is dissolved in benzole and used on bright steel parts of tools and machines. — John H. Varley, Rep. No. 19629.

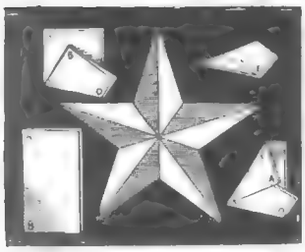


Home-Made Candle

One can make a good candle by filling a tinfoil cup with wax and inserting a wick. The wax will burn until completely consumed. — L. Carpenter.

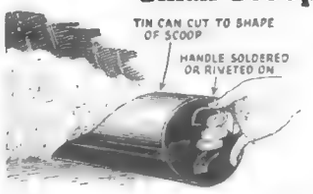


One-Cut Star



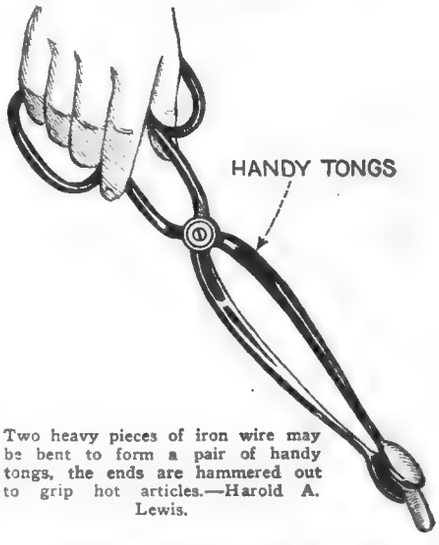
To make a five-pointed star with one cut of the scissors fold paper in half then across C-D, then as in lower right-hand corner; then cut along dotted line.

Small Scoop



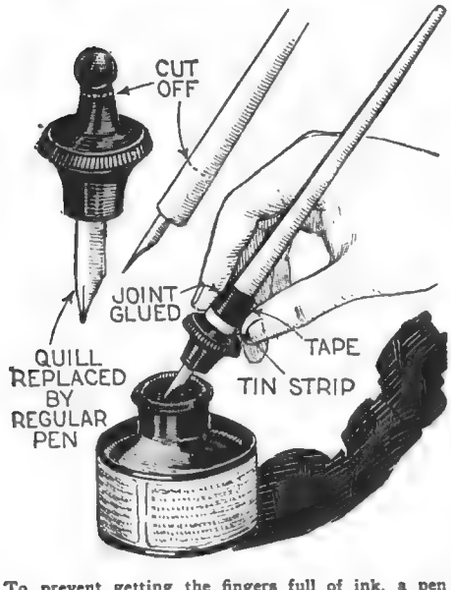
This can be made by cutting tin cans to the required shape and soldering or riveting a handle thereto. — W. Scholl.

Tongs



Two heavy pieces of iron wire may be bent to form a pair of handy tongs, the ends are hammered out to grip hot articles.—Harold A. Lewis.

Drawing Ink Supply



To prevent getting the fingers full of ink, a pen holder is attached to the top of the regular quill holder as illustrated.—F. E. Ebel. Rep. No. 6774.

TO MAKE GOLD PAINT

For making gilt figures, etc., like new.
1 oz. shellac (bleached)
½ oz. best bronze powder.
¼ oz. alcohol.

Mix thoroughly and apply with a soft brush. Remove all dust before painting.

—Contributed by John H. Valcy.

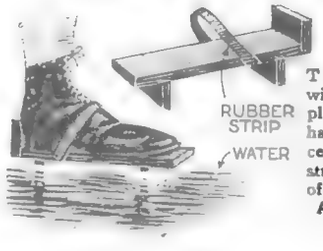
REMOVING IODINE STAINS.

IODINE stains are sometimes very hard to remove and it is not advisable to use strong chemicals of any kind to dispose of them, and as iodine has a tendency to weaken fabrics, it is rather important not to have to rub the goods hard. The garments with iodine stains are to be soaked in starch water over night for a period of about 8 or 9 hours. It is no harm if it is more. Water and lump starch can be used and it is important that the garments be entirely covered. The goods can be pressed down with a stick. It is a nicer way to use a thick starch solution to add to the water instead of the lump starch. In the morning remove the garment and wash, using common laundry soap and you will find the stain is entirely gone.

Do not let the stains remain without attention, as they may injure the cloth.

—Contributed by Nina Jeffers.

Pattens for Wet Days



These pattens will find a ready place in homes having flooded cellars. The strap is a piece of inner tube.— Arthur Moyer.

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

ASTROLOGY

Editor, SCIENCE AND INVENTION:

Have just finished reading in SCIENCE AND INVENTION Magazine, April issue, your article "Superstition." Your criticism of fear produced in the minds of some people in meeting a black cat, or in walking under a ladder, we fully agree with you is "Superstition," but further along where you class Astrology as a "superstitution" and pseudo-science, you show up crass ignorance of the subject.

Every critic who tackles this subject makes a sorry mess of it, showing up in a very decided manner that he does not know what he is talking about. Condemnation without investigation is one of the frailties of human nature. Critics glibly state that Astrology is an exploded science, they fail though to state who exploded it—Can you?

R. A. Proctor, (an opponent), declared that Astrology, was the nursing mother of Astronomy. Astrology was the beginning of all science, also the beginning of man's religion, by his worship of the stars and later in his recognition of the "truth" of the Divinity beyond, or the controlling force governing all celestial motions.

The writer has made an exhaustive study of Astrology, for the past twenty-two years, and in all this research finds same directly antagonistic to any form of "superstition." For your benefit we quote from the dictionary, analysis of word "superstition: Belief in the marvelous, A veneration of sacred relics." The true Astrologer believes only in natural law as expressed through celestial correspondence, this governed by an unseen, but master intelligence. The worship of saints, or religious relics has no appeal whatever to any highly intelligent man, this includes all those interested in Astrology.

In your article you failed to make mention of Friday, the so-called unlucky day, a superstition with many people, more so if Friday comes on the 13th. Astrology lays bare this superstition, you can believe it or not, as well as many other foolish ideas foisted upon humanity by false teachers of religion.

We have also many false practitioners of medicine, possessing a license mind you, who are grafting continually upon the credulous to the tune of millions of dollars each year, but the above citations are no excuse for you to attack true Astrology, or for astrologers to attack true medical science, or true religion. In this as in Astrology, we know whereof we speak, as my lately deceased father was a physician, a very broad-minded and successful practitioner, now much lamented by his former patrons, he was also a great admirer of the science of Astrology.

For your information, we beg to state that Astrology is not as you state a pseudo science. Astrology is a master science, the science of "cause and effect." There can be no effect taking place on this earth without a cause. The cause is celestial.

Astrology as a science, is royally worthy of being termed such. True there are pseudo astrologers, who graft upon others, but this, the United States Astrological Society, composed of true students, have and are ready at all times to assist the government in the expose of such fakers.

Astrologers feel indebted to the Rev. John Butler, formerly rector of Litchborough, England, a former fierce opponent of Astrology, publishing his opposition articles in a prominent London newspaper. Butler, in order that he might be in a better position to expose Astrology, was big enough to thoroughly investigate the subject. The result of his investigations was that he became a booster and added to the literature of Astrology one of its most scientific works.

Before you publish any more remarks about Astrology being a "superstition", muster up your good sense and investigate. You will not exhibit again a decidedly crass lack of knowledge of this subject now being pursued in the United States by a legion of highly intelligent people.

JOHN MANSON, JR.,
Lincoln, Calif.

(We beg to differ with the writer of the above letter and would advise that although he may believe Astrology to be a master science, we are of the firm belief that it is merely a pseudo-science. As a matter of fact, the term science should not even be associated with Astrology. There is nothing scientific in Astrology whatever. Inasmuch as you have quoted the definition of "Superstition", let us quote Webster's definition of "'Astrology'. In the etymological signification, the science of the stars; among the ancients, synonymous with astronomy; subsequently, the pseudo science which treats of the influences of the stars upon human affairs, and of foretelling terrestrial events by their position and aspects. Astrology formerly enjoyed general acceptance, having been practiced by the Chaldeans, Egyptians, Greeks, Romans, Arabs, etc. It flourished in Europe as late as the 17th century, though it was most in vogue during the 14th and 15th." Time and again we have made tests, some of them with large bodies of astrologers in which the findings of thirty or more individuals were all incorporated into one horoscope, and even in these we have found that each manuscript contradicted itself dozens of times and that each was ninety-seven per cent incorrect; three per cent of the statements given were nearly correct, but they were put in such a weak manner that their value was practically negligible. For instance, the statement, "We do not see how the subject could have lived, but if he is alive, he is probably very ill and will die soon, and if he lives to be thirty-one, he will enjoy good health." This was one of the statements which were given to us. Now it stands to reason that a statement of this nature would have to be correct. You either died when you were young, you will be ill, or you may attain a ripe old age. Such a statement would befit anyone in the United States, but it isn't a statement of fact and if Astrology develops findings of this nature, it certainly cannot be called a "Science." When a chemist says that hydrogen and oxygen combine to form water, he makes a definite statement. There are no ifs, ands or buts. We will be glad to entertain the findings of any astrologer, and will publish those findings if when given they will be positive and definite assertions. They should not be warped and distorted by a number of conflicting clauses which neutralize the statements given. If there is any astrologer in the United States who cares to accept the challenge, we will send him a birth date known up to the minute; in fact almost to the second. We will tell him whether the subject is male or female, and let him go ahead and give us the horoscope.—EDITOR).

AMAZING STORIES

THE new scientific fiction magazine, AMAZING STORIES, will be on the newsstands June 10th. Here is a magazine after your own heart. Readers of this magazine who have read the scientific fiction stories for years will welcome AMAZING STORIES with open arms.

The new magazine contains only scientific type fiction stories and in the very first issue there is a story, "Off on a Comet," by the immortal Jules Verne, stories by H. G. Wells, George Allen England, G. Peyton Wertenbaker, and others from the pens of the foremost scientific fiction writers.

AMAZING STORIES has secured the sole rights to all of Jules Verne's stories, written by this, the greatest of all scientific fiction writers. All of these stories will appear in AMAZING STORIES.

Be sure to get your copy today.

The magazine is edited by Hugo Gernsback.

PRICE 25c PER COPY.

SNAKES ON END

Editor, SCIENCE AND INVENTION:

I have a constructive criticism to make on the material presented in your magazine. Would it not be well to check up as carefully on the pictures you publish as on the statements that accompany them? A false idea can be conveyed as easily in a picture as by words, possibly more easily. For example on page 1002 of the March, 1926, number of SCIENCE AND INVENTION Magazine there is a short article about the Colorado woman who killed 140 rattlesnakes, and in the picture that accompanies it the only snake that is shown in a natural position is the dead one under her feet! When a rattlesnake attacks it must strike from a coil, which is looped back and forth from side to side on the ground like a figure eight. The head is drawn back on this coil and the tail usually a little raised. Not one of these snakes is pictured in such a position nor in a natural crawling position. On the other hand they are looped up from the ground in a position that no snake ever takes.

Again in the article on "Oddities of Sound" on page 1008, would any physics instructor agree that the lightning is correctly pictured? Numerous photographs, (I have taken some myself) show that lightning follows crooked paths but never the conventional zigzag ones. Possibly a closer scanning of the magazine would show more mistakes, but these will suffice to illustrate my point.

In closing please let me state that I am an instructor in Biology and have spent some time studying and photographing snakes.

PHILIP H. POPE,
Walla Walla, Wash.

(You are absolutely correct in your statements and we really have no excuse to make except from the standpoint of making attractive illustrations. Ordinarily lightning in a picture is never illustrated as it actually appears in the sky. Were anyone to show black lightning in a drawing, the majority of people would laugh. Yet such a thing as black lightning has actually been photographed. Illustrations of black lightning appeared in this magazine years ago. Nevertheless we thank you for your letter and appreciate your careful observations of details.—EDITOR).

Dr. Hackensaw Is Back

THE Clement Fezandié "Hackensaw" stories which have run for a long time in SCIENCE AND INVENTION will now be found in AMAZING STORIES.

They will be regularly published in that magazine, and the July number may now be found on all newsstands.

COMPLIMENT

Editor, SCIENCE AND INVENTION:

I have just finished reading your March issue of SCIENCE AND INVENTION Magazine. There have been helpful articles for me published such as the one on "Statue Pictures", but what I want to compliment you on especially is the educational work you are doing. I am quite sure that I am not exaggerating when I write that you are doing more science teaching in your quiet way than all the high-schools, colleges and universities in this country. I personally, believe you are, judging from my experience as a high-school science teacher. My only regret is that because of merchandising difficulties, your magazines, RADIO NEWS and SCIENCE ANL INVENTION, cannot be obtained in all small villages of this country of ours the same as we can now buy "Racy Stories", "Blood and Thunder", etc.

Wishing you all possible financial and other success,

WALTER A. BUCHHEIM,
Denver, Colo.

(We thank you for your letter and assure you that the editors all appreciate your sentiments. We always try to make SCIENCE AND INVENTION *Magazine better every month and appreciate both compliments and criticisms, even though we do not always find room for them on the Readers Forum page. The editors have a great many letters on hand which would make interesting reading, but which, due to lack of space, cannot possibly find their way to this page. Nevertheless each and everyone of the letters are read with a great deal of interest. Don't think that your letter finds its way to a wastepaper basket without being looked over.*—EDITOR).

MOVIE EXPOSES

Editor, SCIENCE AND INVENTION:

I am writing to state my feelings toward this magazine and the topics discussed in your Readers Forum. I am fourteen years old and for quite a part of that number I have been a satisfied reader of SCIENCE AND INVENTION.

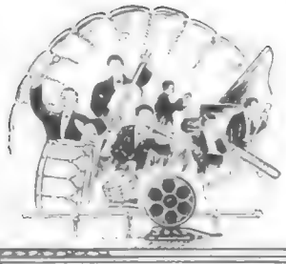
I do not altogether agree with L. M. Fisher as to some facts, concerning movie exposés, brought out in his letter in the May number. I think that the majority of movie fans realize that many parts of sensational films are "fake", but for that reason are still more anxious to know how the illusions, are produced. The knowledge of this, however, does not detract from the interest of the public for the pictures.

I am very much pleased with AMAZING STORIES and in answer to the printed request of the editor wish to state that publishing serials and short stories is far better than a magazine containing merely one complete story. I am also very anxious to read the hitherto unpublished "Dr. Hackensaw's Secrets" mentioned.

In closing, I will say that while pleased with the new publication and aware of the fact that it is a totally different type of magazine, that nothing will ever be placed on the market to equal good old "S. & I.".

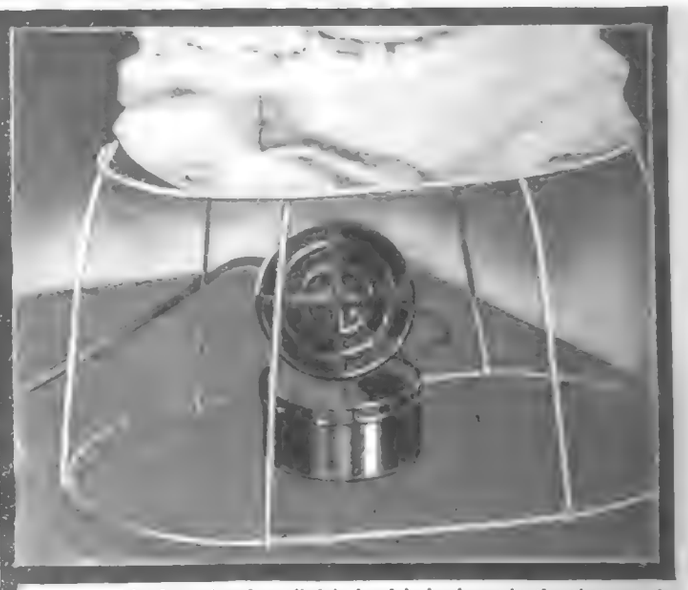
THOMAS MORTON,
Annapolis, Md.

(Thanks, Mr. Morton, you have exactly expressed our sentiments with regard to film exposés. We believe they do more good than harm in the spectacular movie field to [illegible] development of new ideas and [illegible] older effects.—EDITOR).



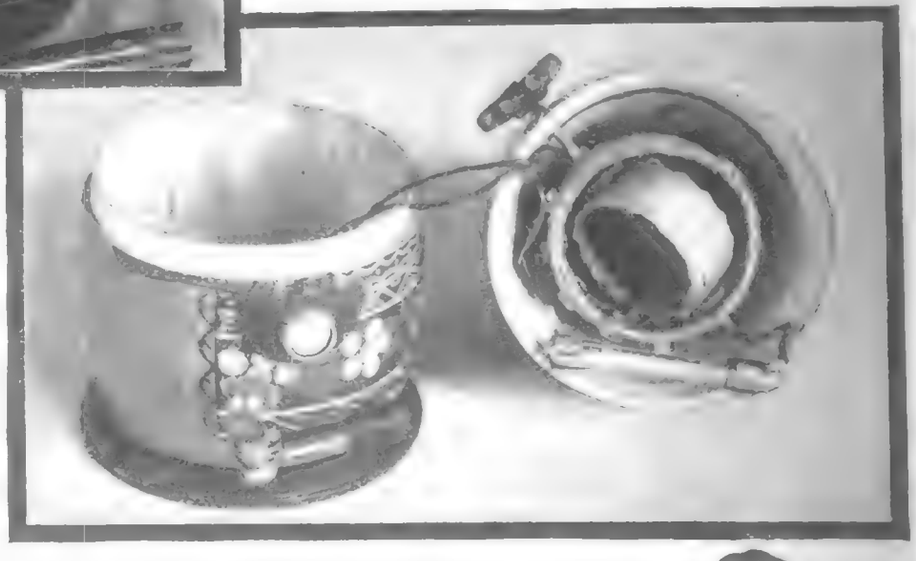
RADIO

Novelties In the Radio World



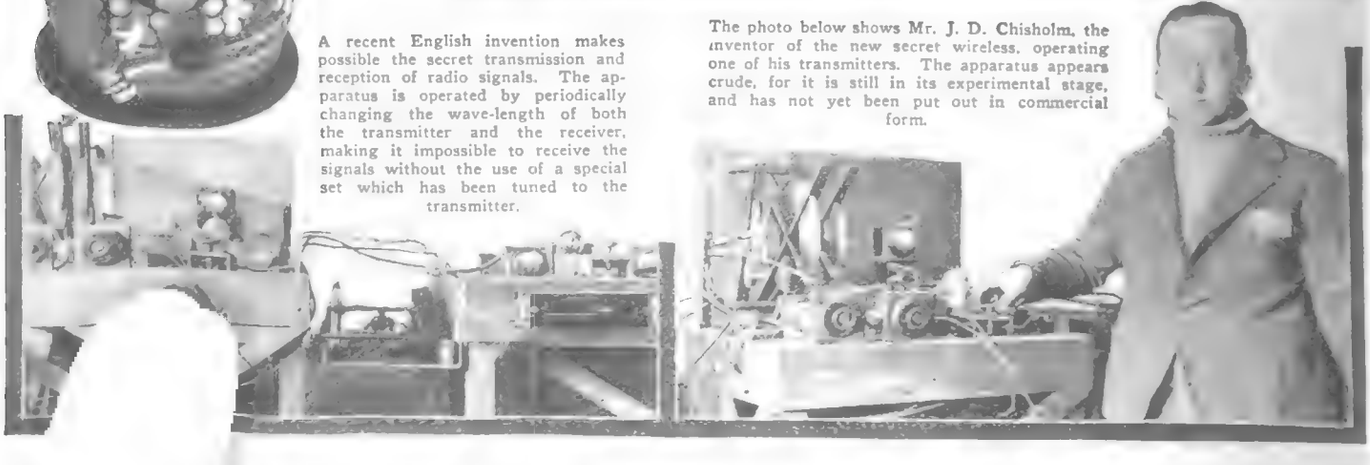
A novel loud speaker for milady's boudoir is shown in the photo at the left. A doll, dressed in the fashion of a colonial dame, conceals a midget loud speaker unit.

A Russian concern has recently produced a crystal set built inside of a hollow manikin. The controls are almost inconspicuous, blending with the designs on the figure.



A recent English invention makes possible the secret transmission and reception of radio signals. The apparatus is operated by periodically changing the wave-length of both the transmitter and the receiver, making it impossible to receive the signals without the use of a special set which has been tuned to the transmitter.

The photo below shows Mr. J. D. Chisholm, the inventor of the new secret wireless, operating one of his transmitters. The apparatus appears crude, for it is still in its experimental stage, and has not yet been put out in commercial form.



Great Composers in WRNY Programs

By CHARLES D. ISAACSON

EVELYN HIRSH
Pianiste, who puts plenty of pep in jazz selections over WRNY.

ARTHUR WILLIAMS
Of the New York Edison Co., a genial and interesting speaker at WRNY.

Marguerite Namara
Prima Donna, and Star of "Pinafore" sang at WRNY to aid a charity.

Harry T. Burleigh
Finest of negro singers and composers, sang his spirituals at WRNY.

IDA GEER WELLER
Gives "The Message of the Hymns," a sacred music series, at WRNY.

ERNEST TRUEX
Star of "Pomeroy's Past," broadcast recently a talk over WRNY.

RUTH NUGENT
Youngest of the well-known dramatic family, was a recent WRNY visitor.

Luigi Constantino
Pianiste and vocal authority, leads fortnightly concerts at WRNY.

THE Editor of RADIO NEWS has asked me to begin a new feature this month: that is to tell you in every issue about some great composer or great work in music. So I am going to tell you just a word or two about the greatest of the Italian grand opera writers, Guiseppe Verdi. My reason for taking him is that we had a very beautiful program of selections from his operas in one of the series of Ferruccio Corradetti.

The fact that everybody remembers about Verdi is that he came of the poorest of families, starved when he was a boy, and during the writing of his first operas, which were considered utter failures. He was living in a garret in Milan when his first success was heralded, and this came only after the tragedy of the death of his wife and baby. For half a century Verdi wrote operas, every one of which is practically immortal. To me the greatest of his operas is "Aida," with its Egyptian atmosphere, but the one I prefer for popular melody is "Rigoletto," the story of the deformed villain whose plot came back like a boomerang upon his young, innocent daughter, Gilda. There is the opera "Traviata," with the great love sacrifice of Violetta; and "The Forces of Destiny," whose title explains the tale.

From the point of box-office popularity, "Il Trovatore" leads, with "The Troubadour," the "Miserere," "Home to Our Mountains" and melodies familiar even to every school boy in the United States. The quality which marks Verdi's popularity is that his melodies quickly caught the people's fancy, yet have such sincerity and depth that one never tires of them. Verdi had an original sense of dramatic effects, generally written to texts of characters which seem to live and breathe.

Signor Corradetti, who is conducting the Sunday afternoon "Operatic Composer" series, is a man who has had a very brilliant career. He has appeared on the leading operatic stages of Italy and other countries, and has won high honors by creating and interpreting important parts.

Another composer series which we are running at WRNY is that of Herbert Soman, conductor of Orlando's Roosevelt Concert Orchestra, every Monday night. We have had programs of Brahms, Beethoven Debussy and McDowell, and in this series I am going to tell you something about the orchestral composers from time to time.

If you have any operatic story in mind that you would like to have me tell, or if there is any particular composer about whom you would like to know, just write to me at WRNY, and I will gladly comply with your request.

THE EDISON HOUR

We have had a very interesting month at WRNY. The biggest happening is the acquisition of the New York Edison Hour, with Edison ensemble, unsurpassed by any

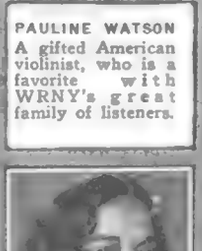
(*Continued on page* 280)

LOUIS MARSHALL
Famous jurist, spoke at the Jewish Relief dinner broadcast by WRNY.

THEODORA IRVINE
Director of the Irvine Players and Irvine School, directs radio drama at WRNY.

GRANT MITCHELL
Star of "One of the Family" and of the Edison Prize Play, is a frequent WRNY visitor.

Capt. George Fried
Of the "President Roosevelt," was an honored guest of WRNY recently.



PAULINE WATSON
A gifted American violinist, who is a favorite with WRNY's great family of listeners.

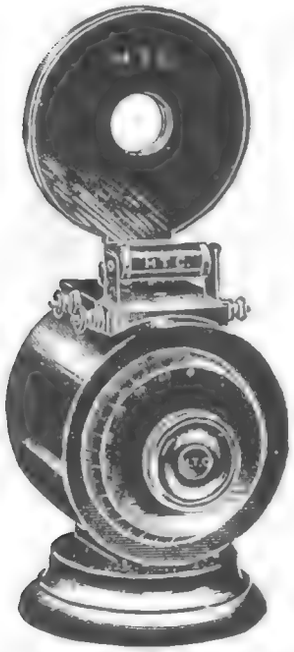
Swami Yogananda
Indian mystic, who began his tour of America with an address over WRNY.

JOSEPH BONIME
Director of the Edison Ensemble at WRNY, and well known as the accompanist of Mischa Elman.

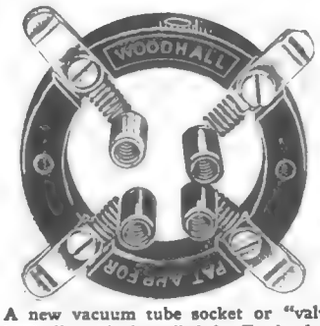
CLIFFORD ODETS
"The Rover Reciter," who gives an entertaining feature on WRNY's regular programs.

New Foreign Radio Apparatus

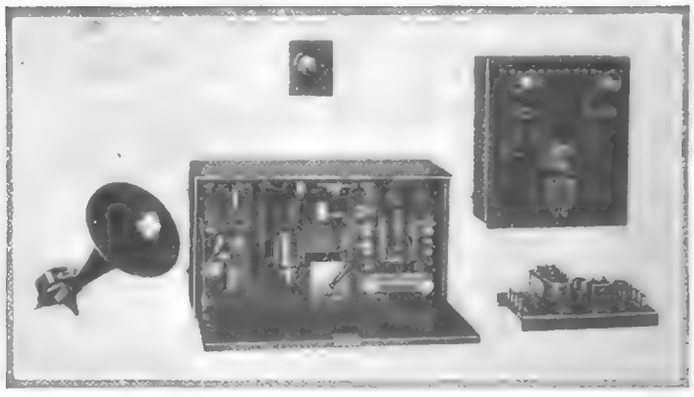
Illustrations Show the Latest in European Radio Sets and Parts and Should Suggest Some Novel Ideas to the Radio Fan.



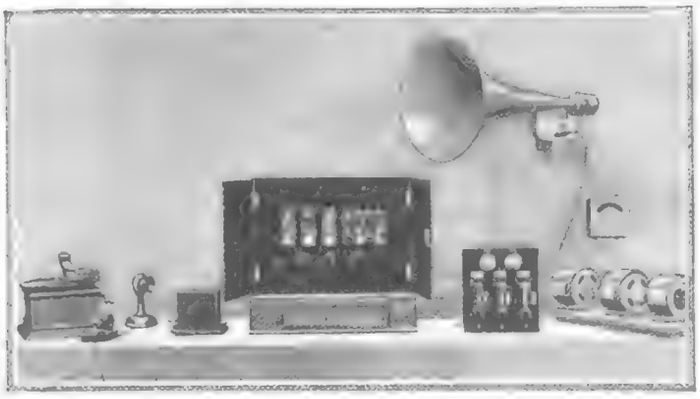
A newly designed crystal detector type of receiver employing what the British term a "slab" coil for an inductance and a variable tuning condenser is shown in the illustration above. The small cartridge mounted directly in front of the inductance houses the fixed crystal detector and it is interchangeable so that the most sensitive unit available can be quickly determined. The flat-wound "slab" coil is interchangeable and is held between two spring clips, thus fascilitating quick removal yet insuring perfect contact at all times. Although this receiver accomplishes some very good results, it is but 9 inches high, 4 inches wide and 4½ inches deep. The only additional accessories necessary for the operation are an antenna and ground and a pair of phones. For simplicity and novel design, this set is noteworthy.



A new vacuum tube socket or "valve holder" as it is called in England is shown above. This socket is of the anti-microphonic type and the principle of suspending the tube is readily grasped. Four spiral springs support four small brass tubes and insure perfect freedom from vibration of the tube elements. The spiral springs are extended upward into the tubes and serve to grip the vacuum tube prongs firmly and thus establish perfect contact. Furthermore, there is only air dielectric between adjacent tube sockets, something highly desirable in very sensitive receivers. This socket is also made adjustable for adaptation to various tubes.



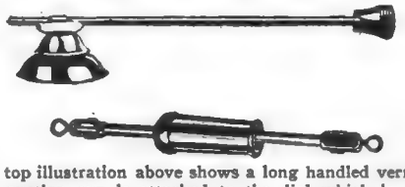
The apparatus shown in the above illustration is one of the latest English types of portable military transmitters and receivers. The apparatus consists of a 20 watt outfit with a call bell and loud speaker each of which can be used interchangeably when communication is being carried on over short distances. It is said that this outfit is suitable for consistent communication by radio telephony up to 15 miles and by radio telegraphy up to 45 miles. Both transmitter and receiver are adapted to cover a wave band of 375 to 425 meters. The entire apparatus is not only of value for military purposes but is also designed for use on lightships and in other isolated positions where communication other than by radio is impossible or impracticable. Such a set would be a boon to a lonely lighthouse or lightship tender.



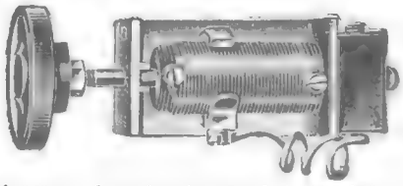
While the layout shown in the above illustration is not strictly a radio set, still much of the apparatus used in it finds applications in the radio field. It is a Marconi repeater installation designed for ships. By means of a microphone, an amplifier and a loud speaker, orchestral or phonograph music can be relayed to a distant point and reproduced with perfect clarity.

The drawing above shows one of the cleverest little dial indicators that we have seen in a long time. It not only serves to assist in tuning, but it also tells at a glance just what instrument is controlled by the dial below it. It is only necessary to drill a hole in the panel and clamp the indicator in position. Several different styles are supplied.

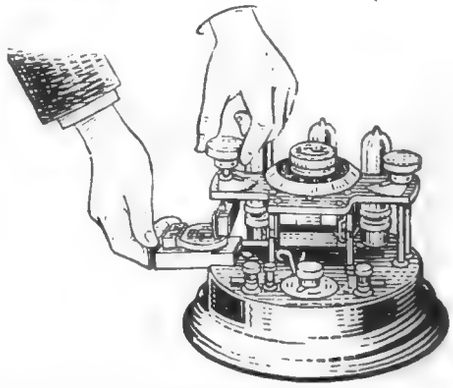
A vernier rheostat is often of great assistance in controlling the detector tube of a radio receiving set and here is one of rather unusual construction wherein the resistance is so wound that it requires three full turns of the control knob to turn the rheostat all the way on. Obviously, a few degrees rotation of the knob makes only a very small change in the resistance.



The top illustration above shows a long handled vernier. The suction cup is attached to the dial which is then rotated by the long handle. The lower photo above shows an unusual type of antenna insulator. It is designed to be weatherproof.



Another type of vernier rheostat that necessitates several turns in order to proceed from minimum to maximum resistance or vice versa is shown above. Rotating the control knob causes the contactor to travel along the spiral of wire and thus cut resistance into or out of the circuit according to the directions in which the control knob is turned. Very minute and critical adjustment of the filament temperature can thus be obtained.

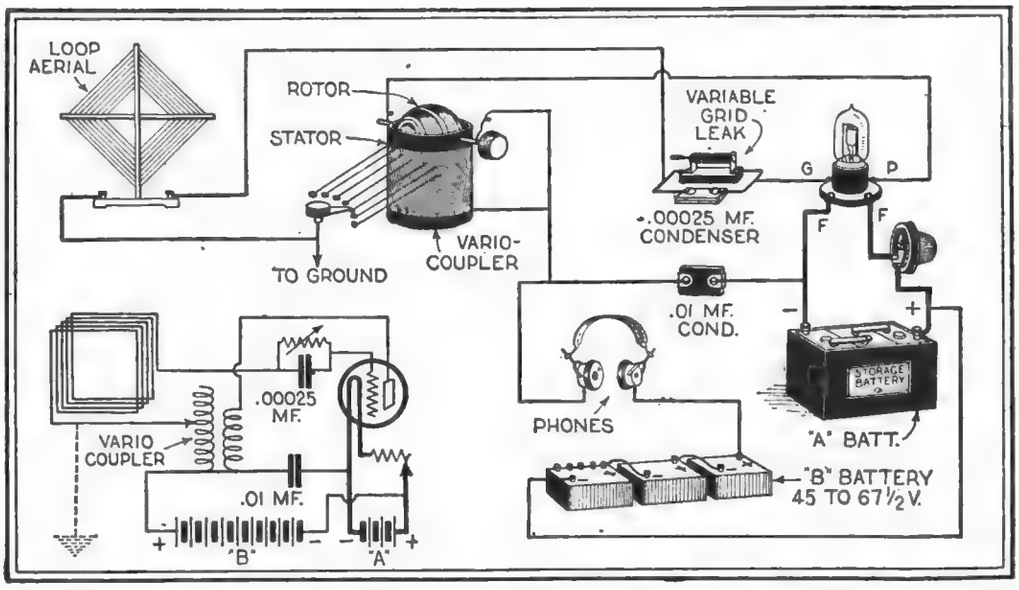


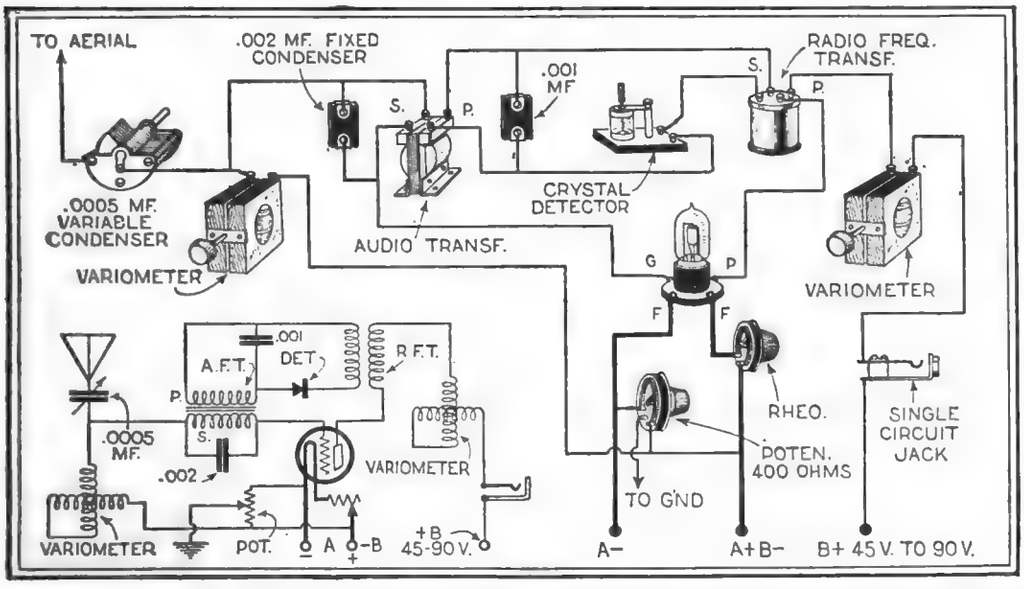
Here is shown a most unusual type of three tube receiver using interchangeable inductances. A reflex circuit using resistance coupling is employed and interchangeable coil units are supplied which will enable the operator to cover wave-length bands of from 250 to 550 and 1,300 to 3,000 meters. There is only one actual tuning control in this set, which control is the dial in the center. Three coils are employed and their variable relationship to each other is adjustable by means of the two knobs. By pulling upward on these knobs, coils are released and may be interchanged in order to reach another wave-length band. In the illustration, one of the coils is shown being removed from the receiver. The tubes or valves are mounted in shock-proof sockets which reduce microphonic effects and the tubes can be seen projecting above the set in the rear. Tube filament controls are mounted on the base.

A Page of Unusual Circuits

By Three Experimenters

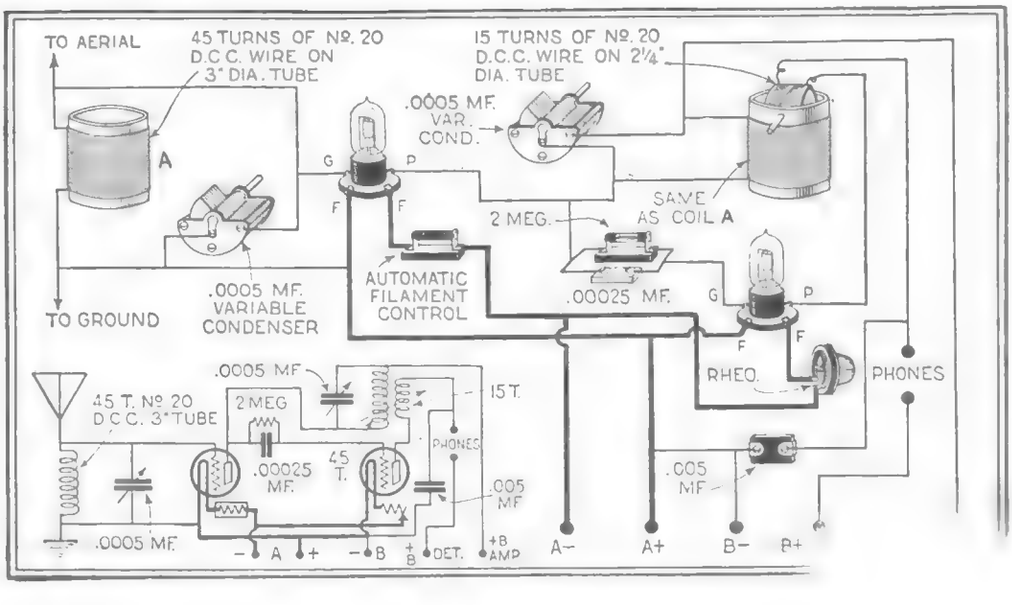
A SINGLE tube receiver employing a loop antenna may readily be used if it is to be situated close to one or more fairly powerful broadcasting stations. Unusual selectivity will be found in a receiver of this nature, particularly when regeneration is added to the detector. The circuit diagram at the right shows the connections for such a circuit. A standard type of vario-coupler is employed for tuning the loop circuit, the grid circuit and providing a tickler coil for regeneration. Note the fairly large condenser in the grid return leak. By proper selection, it is possible to make this circuit operate as a super-regenerator. A good type of variable grid leak and a finely adjustable rheostat are necessities. The grid leak is adjusted to a point where the set does not quite oscillate.—Lee H. Bolen.





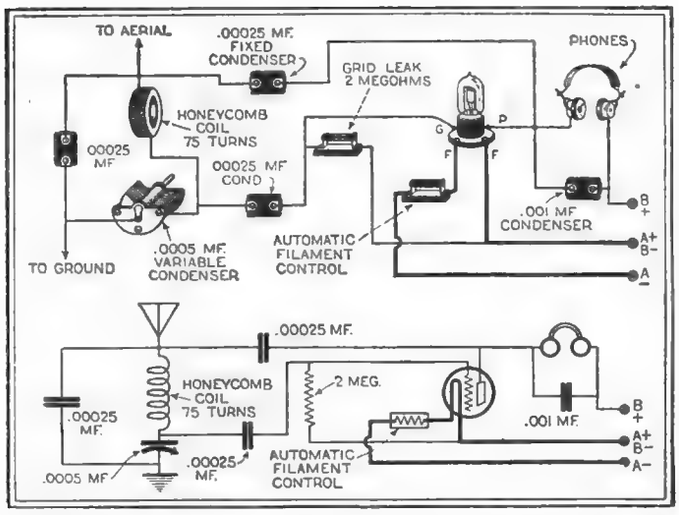
IT used to be almost an axiom that regeneration cannot be used with a reflex circuit. This, however, has been disproved several times as evidenced by the results obtained with the circuit diagram shown at the left. Here a more or less standard type of reflex receiver is employed, with a variometer added to the plate circuit to produce regeneration by the tuned plate method. Oscillation of the circuit is controlled by a potentiometer. It is advisable to employ a fixed detector rather than an adjustable one and a detector using a carborundum crystal is to be preferred because of its stability and rugged qualities. Such a detector is not easily burned out by even very strong signals. The writer added two stages of audio frequency amplification to this circuit and obtained loud speaker results even on "DX" stations which came in well. H. C. Dixon, Rep. No. 15908.

TUNED impedance radio frequency amplification with regeneration in the detector circuit makes the receiving set illustrated at the right very efficient and good for "DX". In case the reader finds trouble in stabilizing a set of this type and cannot prevent it from oscillating when the R.F. and detector circuits are tuned to resonance, he can try adding a potentiometer directly across the "A" battery and connecting the center post of the potentiometer to the grid return lead of the R.F. tuning circuit. Adjustment of this potentiometer will stabilize the set remarkably and will enable reception with all kinds of tubes. A receiver of this nature should be used with an antenna at least 65 feet long, although in congested districts it may be necessary to reduce this length in order to achieve good enough selectivity to tune out powerful locals.—Loring Margiot.

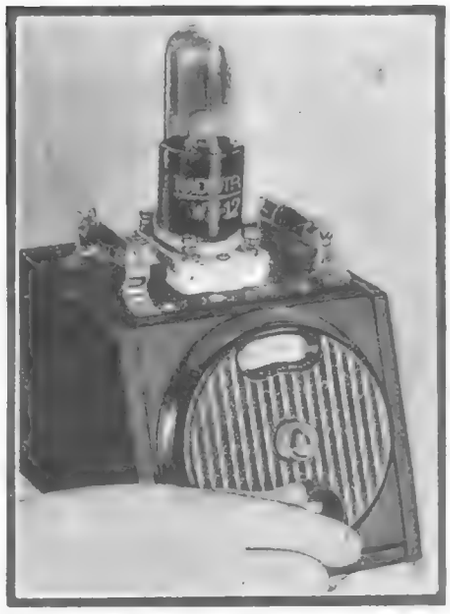


One Tube---One Control

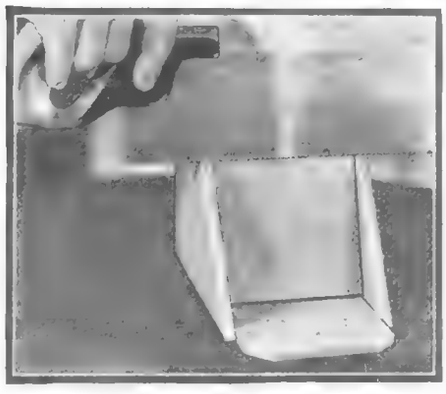
Unique Cabinet And Simple Circuit Makes Presentable And Efficient Receiver



THE circuit of this simple single tube single control receiver is shown directly above. By using the unusual regenerative circuit shown, excellent results may be expected for "DX" reception, particularly if a good antenna is employed. It is of course not necessary that the particular circuit shown be adhered to for constructing a receiver similar to that shown in the upper right-hand corner of this page, inasmuch as any standard single-controlled circuit can be adapted for a very small space with few if any changes. The circuit shown above was selected for simplicity but if a compact set of this nature is to be used in a congested district, it is well to use a circuit that is loosely coupled to the antenna so as to prevent annoying radiation. In any event, honeycomb coils can be employed for the tuning inductances as they are very compact and easily mounted.—HERBERT HAYDEN.



The photograph reproduced on the right shows the external appearance of this single control, single tube receiver. The single dial is located on the sloping front panel, while the tube socket is mounted on the top of the cabinet, flanked on either side by two resistance clips. One of these sets of clips holds the grid-leak, while the other set makes contact with the ends of the automatic control filament resistance. Within the cabinet may be located any type of compact variable condenser, a 75-turn honeycomb coil and the fixed condensers.



The cabinet that houses this small set is an ordinary salt box with a sloping top such as is found in any five and ten cent store. The photo at the left shows how the projecting sides are cut off so that what was formerly the top of the salt box will become the inclined panel of the new receiving set. After the set has been constructed and wired, the panel can be fastened to the rest of the cabinet by means of a few thin brads or wood screws.

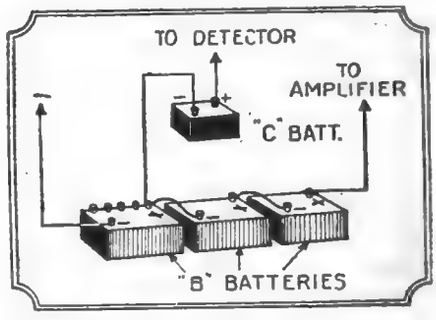
Aids to Radio Reception

Practical Hints of Interest To All

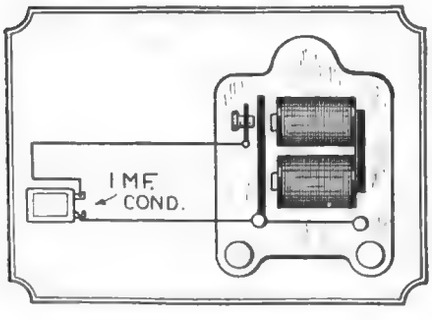
When the door bell rings, or a buzzer in the house buzzes, do you hear the sound in the phones or loud speaker of your radio receiving set? If so, this trouble can be overcome by connecting a 1 mf. condenser directly across the contacts of the bell or buzzer. A standard buzzer and a suitable condenser is shown above, while the method of connecting the two together is shown below. The remainder of the bell or buzzer circuit is not changed.

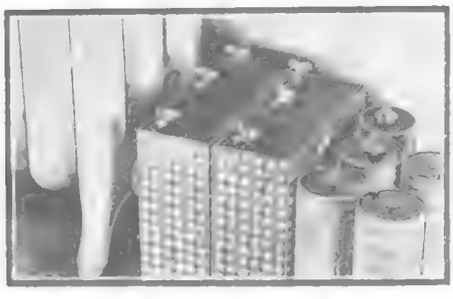
Above: A very simple test set for determining continuity of circuits consists of a small buzzer taped to a "C" battery and a pair of flexible leads. Touching the two lead tips to a continuous circuit causes the buzzer to sound.

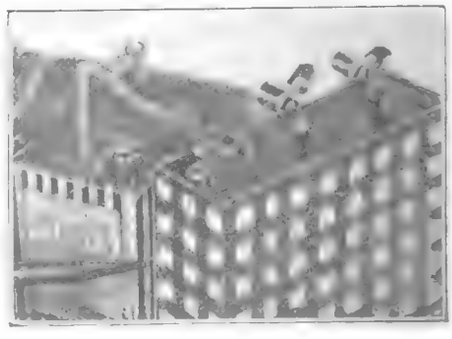
Below: If your "A" and "B" batteries have been placed beside a radiator all winter, such treatment has probably aided in reducing their lives and they probably need replenishing.



Doesn't it always seem to be the case that the "B" battery voltage drops off to a non-operating point just when you most desire to use the set? Often it happens that the voltage applied to the detector is not quite sufficient to make that tube operate properly, and that the next available voltage is too high. In this case, connect the "C" battery in series with the detector plate circuit as shown in the diagram above and in the reproduced photograph below.







List of Broadcast Stations in the United States

Radio Call Letter	BROADCAST STA. Location	Wave (Meters)	Power (Watts)
KDKA	East Pittsburgh, Pa.	309.1	Var.
KDLR	Devils Lake, N. D.	231	5
KDYL	Salt Lake City, Utah	246	50
KFAB	Lincoln, Neb.	340.7	1000
KFAD	Phoenix, Ariz.	273	100
KFAF	San Jose, Calif.	217.3	50
KFAU	Boise, Idaho	280.2	750
KFBB	Havre, Mont.	275	50
KFBC	San Diego, Calif.	215.7	50
KFBK	Sacramento, Calif.	248	100
KFBL	Everett, Wash.	224	100
KFBS	Trinidad, Colo.	238	15
KFBU	Laramie, Wyo.	270	500
KFCB	Phoenix, Ariz.	238	100
KFDD	Boise, Idaho	278	50
KFDM	Beaumont, Tex.	315.6	500
KFDX	Shreveport, La.	250	100
KFDY	Brookings, S. Dak.	273	100
KFDZ	Minneapolis, Minn.	231	10
KFEC	Portland, Ore.	248	50
KFEL	Denver, Colo.	254	50
KFEQ	Oak, Nebr.	268	500
KFEY	Kellogg, Idaho	233	10
KFFP	Moberly, Mo.	242	50
KFGQ	Boone, Iowa	226	10
KFH	Wichita, Kans.	268	500
KFHA	Gunnison, Colo.	252	50
KFHL	Oskaloosa, Iowa	240	10
KFI	Los Angeles, Calif.	468.5	4000
KFIF	Portland, Ore.	248	100
KFIO	Spokane, Washington	265.3	100
KFIQ	Yakima, Wash.	256	100
KFIU	Juneau, Alaska	226	10
KFIZ	Fond du Lac, Wis.	273	100
KFJB	Marshalltown, Iowa	248	10
KFJC	Junction City, Kansas	218.8	10
KFJF	Oklahoma City, Okla.	261	500
KFJI	Astoria, Ore.	246	10
KFJM	Grand Forks, N. Dak.	278	100
KFJR	Portland, Ore.	263	50
KFJY	Fort Dodge, Iowa	246	50
KFJZ	Fort Worth, Tex.	254	50
KFKA	Greeley, Colo.	273	50
KFKU	Lawrence, Kans.	275	500
KFKX	Hastings, Nebr.	288.3	5000
KFKZ	Kirksville, Mo.	225.4	10
KFLR	Albuquerque, N. Mex.	254	100
KFLU	San Benito, Tex.	236	10
KFLV	Rockford, Ill.	229	100
KFLX	Galveston, Tex.	240	10
KFLZ	Anita, Iowa	273	100
KFMR	Sioux City, Iowa	261	100
KFMW	Houghton, Mich.	263	50
KFMX	Northfield, Minn.	336.9	500
KFNF	Shenandoah, Iowa	263	1000
KFOA	Seattle, Wash.	454.3	1000
KFOB	Burlingame, Calif.	226	50
KFON	Long Beach, Calif.	233	500
KFOO	Salt Lake City, Utah	236	250
KFOR	David City, Nebr.	226	100
KFOT	Wichita, Kans.	231	50
KFOX	Omaha, Nebr.	248	100
KFOY	St. Paul, Minn.	252	50
KFPL	Dublin, Texas	252	15
KFPM	Greenville, Texas	242	10
KFPR	Los Angeles, Calif.	230.6	500
KFPW	Carterville, Mo.	258	20
KFPY	Spokane, Wash.	266	100
KFQA	St. Louis, Mo.	261	100
KFQB	Fort Worth, Texas	508.2 & 263	1000
KFQD	Anchorage, Alaska	227.1	100
KFQP	Iowa City, Iowa	224	10
KFQU	Alma (Holy City) Calif.	217.3	100
KFQW	North Bend, Wash.	215.7	50
KFQZ	Hollywood, Calif.	225.4	50
KFRB	Beeville, Tex.	248	250
KFRC	San Francisco, Calif.	268	50
KFRU	Columbia, Mo.	499.7	500
KFRW	Olympia, Wash.	218.8	50
KFSG	Los Angeles, Calif.	275	500
KFUL	Galveston, Tex.	258	50
KFUM	Colorado Springs, Colo.	239.9	100
KFUO	St. Louis, Mo.	545.1	500
KFUP	Denver, Colo.	234	50
KFUR	Ogden, Utah	224	50
KFUS	Oakland, Calif.	256	50
KFUT	Salt Lake City, Utah	261	100
KFUU	Oakland, Calif.	220	50
KFVD	San Pedro, Calif.	205.4	50
KFVE	St. Louis, Mo.	240	500
KFVG	Independence, Kas.	236	15
KFVI	Houston, Texas	240	10
KFVN	Fairmont, Minn.	227	50
KFVS	Cape Girardeau, Mo.	224	50
KFVW	San Diego, Calif.	246	500
KFVY	Albuquerque, N. Mex.	250	10
KFWA	Ogden, Utah	261	500
KFWB	Hollywood, Calif.	252	500
KFWC	Upland, Calif.	211.1	50
KFWF	St. Louis, Mo.	214.2	250
KFWH	Chico, Calif.	254	100
KFWI	So. San Francisco, Calif.	226	500
KFWM	Oakland, Calif.	206.8	500
KFWO	Avalon, Calif.	211.1	250
KFWU	Pineville, La.	238	100
KFWV	Portland, Ore.	212.6	50
KFXB	Big Bear Lake, Calif.	202.6	500
KFXD	Logan, Utah	205.4	10
KFXF	Colorado Springs, Colo.	250	500
KFXH	El Paso, Texas	242	50
KFXJ	Denver, Colo.	215.7	10
KFXR	Oklahoma City, Okla.	214.2	15
KFXY	Flagstaff, Ariz.	205.4	50
KFYF	Oxnard, Calif.	205.4	10
KFYJ	Houston, Texas	238	10
KFYO	Texarkana, Tex.	209.7	10
KFYR	Bismarck, N. Dak.	248	10
KGO	Oakland, Calif.	361.2	4000
KGTT	San Francisco, Calif.	206.8	50
KGU	Honolulu, Hawaii	270	500
KGW	Portland, Ore.	491.5	1000
KGY	Lacey, Wash.	246	50
KHJ	Los Angeles, Calif.	405.2	500
KHQ	Spokane, Wash.	273	500
KJBS	San Francisco, Calif.	220	5
KJR	Seattle, Wash.	384.4	1000
KLDS	Independence, Mo.	440.9	1000
KLS	Oakland, Calif.	250	250
KLX	Oakland, Calif.	508.2	500
KLZ	Denver, Colo.	266	250
KMA	Shenandoah, Iowa	252	500
KMJ	Fresno, Calif.	234	50
KMMJ	Clay Center, Neb.	228.9	1000
KMO	Tacoma, Wash.	250	100
KMOX	Kirkwood, (St. Lo)., Mo.	280.2	1500
KMTR	Los Angeles, Calif.	238	500
KNRC	Los Angeles, Calif.	208.2	250
KNX	Los Angeles, Calif.	336.9	1000
KOA	Denver, Colo.	322.4	5000
KOAC	Corvallis, Ore.	280.2	500
KOB	State College, N. M.	348.6	1000
KOCH	Omaha, Neb.	258	250
KOCW	Chickasha, Okla.	252	200
KOIL	Council Bluffs, Iowa	278	500
KOWW	Walla Walla, Wash.	256	500
KPO	San Francisco, Calif.	428.3	1000
KPPC	Pasadena, Calif.	229	50
KPRC	Houston, Texas	296.9	500
KPSN	Pasadena, Calif.	315.6	1000
KQP	Portland, Ore.	212.6	500
KQV	Pittsburgh, Pa.	275	500
KQW	San Jose, Calif.	231	500
KRE	Berkeley, Calif.	256	100
KSAC	Manhattan, Kansas	340.7	500
KSD	St. Louis, Mo.	545.1	500
KSL	Salt Lake City, Utah	299.8	1000
KSMR	Santa Maria, Calif.	209.7	750
KSO	Clarinda, Iowa	242	500
KTAB	Oakland, Calif.	240	1000
KTBI	Los Angeles, Calif.	293.9	750
KTBR	Portland, Ore.	263	50
KTCL	Seattle, Wash.	305.9	1000
KTHS	Hot Springs, Ark.	374.8	500
KTNT	Muscatine, Iowa	256	500
KTW	Seattle, Wash.	454.3	1000
KUOA	Fayetteville, Ark.	299.8	750
KUOM	Missoula, Mont.	244	250
KUSD	Vermillion, S. D.	278	100
KUT	Austin, Texas	231	500
KVOO	Bristow, Okla.	374.8	500
KWCR	Cedar Rapids, Iowa	278	500
KWG	Stockton, Calif.	248	50
KWKC	Kansas City, Mo.	236	100
KWKH	Kennonwood, La.	261	500
KWSC	Pullman, Wash.	348.6	500
KWUC	Le Mars, Iowa	252	50
KWWG	Brownsville, Texas	278	500
KYW	Chicago, Ill.	535.4	3500
KZIB	Manila, P. I.	249.9	20
KZKZ	Manila, P. I.	270	100
KZM	Oakland, Calif.	240	100
KZRQ	Manila, P. I.	222	500
KZUY	Baguio, P. I.	360	500
NAA	Arlington, Va.	434.5	1000
WAAD	Cincinnati, Ohio	258	25
WAAF	Chicago, Ill.	278	200
WAAW	Omaha, Neb.	384.4 & 278	500
WABB	Harrisburg, Pa.	204	10
WABC	Asheville, N. C.	254	20
WABI	Bangor, Me.	240	100
WABO	Rochester, N. Y.	278	100
WABQ	Haverford, Pa.	261	100
WABR	Toledo, Ohio	263	50
WABW	Wooster, Ohio	206.8	50
WABX	Mount Clemens, Mich.	246	500
WABY	Philadelphia, Pa.	242	50
WABZ	New Orleans, La.	275	50
WADC	Akron, Ohio	258	500
WAFD	Port Huron, Mich.	275	500
WAGM	Royal Oak, Mich.	225.4	50
WAHG	Richmond Hill, N. Y.	315.6	500
WAIT	Taunton, Mass.	229	10
WAIU	Columbus, Ohio	293.9	500
WAMD	Minneapolis, Minn.	244	500
WAPI	Auburn, Ala.	248	1000
WARC	Medford Hillside, Mass.	261	100
WATT	Boston, Mass.	243.8	100
WBAA	West Lafayette, Ind.	273	250
WBAK	Harrisburg, Pa.	275	500
WBAL	Baltimore, Md.	246	5000
WBAO	Decatur, Ill.	270	100
WBAP	Fort Worth, Texas	475.9	1500
WBAX	Wilkes-Barre, Pa.	256	100
WBBL	Richmond, Va.	229	100
WBBM	Chicago, Ill.	226	1500
WBBP	Petoskey, Mich.	238	200
WBBR	Rossville, N. Y.	273	500
WBBS	New Orleans, La.	252	50
WBBW	Norfolk, Va.	222	50
WBBY	Charleston, S. C.	268	10
WBBZ	Chicago, Ill.	215.7	50
WBCN	Chicago, Ill.	266	500
WB C	Grand Rapids, Mich.	256	500
WBES	Takoma Park, Md.	222	100
WBNY	New York, N. Y.	209.7	500
WBOQ	Richmond Hill, N. Y.	236	100
WBPI	Newark, N. J.	263	500
WBRC	Birmingham, Ala.	248	50
WBRE	Wilkes-Barre, Pa.	231	100
WBT	Charlotte, N. C.	275	250
WBZ	Springfield, Mass.	331.1	2000
WBZA	Boston, Mass.	242	250
WCAC	Mansfield, Conn.	275	500
WCAD	Canton, N. Y.	263	250
WCAE	Pittsburgh, Pa.	461.3	500
WCAJ	University Place, Neb.	254	500
WCAL	Northfield, Minn.	336.9	500
WCAM	Camden, N. J.	236	250
WCAO	Baltimore, Md.	275	100
WCAP	Washington, D. C.	468.5	500
WCAR	San Antonio, Texas	263	500
WCAT	Rapid City, S. D.	240	50
WCAU	Philadelphia, Pa.	278	500
WCAX	Burlington, Vt.	250	100
WCBA	Allentown, Pa.	254	15
WCBD	Zion, Ill	344.6	5000
WCBE	New Orleans, La.	263	5
WCBH	Oxford, Miss.	242	50
WCBM	Baltimore, Md.	229	50
WCBQ	Nashville, Tenn.	236	100
WCBR	Providence, R. I.	209.7	100
WCCO	Minneapolis, Minn.	416.4	5000
WCLO	Camp Lake, Wis.	231	50
WCLS	Joliet, Ill.	214.2	150
WCOA	Pensacola, Fla.	222.1	250
WCSH	Portland, Me.	256	500
WCSO	Springfield, Ohio	248	100
WCWS	Providence, R. I.	209.7	100
WCX	Pontiac, Mich.	516.9	5000
WDAD	Nashville, Tenn.	226	150
WDAE	Tampa, Fla.	273	250
WDAF	Kansas City, Mo.	365.6	500
WDAG	Amarillo, Texas	263	100
WDAH	El Paso, Tex.	267.7	50
WDAY	Fargo, N. D.	261	50
WDBE	Atlanta, Ga.	270	100
WDBJ	Roanoke, Va.	229	50
WDBK	Cleveland, Ohio	227	100
WDBO	Winter Park, Fla.	240	500
WDBZ	Kingston, N. Y.	233	10
WDGY	Minneapolis, Minn.	263	500
WDOD	Chattanooga, Tenn.	256	500
WDRC	New Haven, Conn.	268	100
WDWF	Cranston, R. I.	440.9	500
WDZ	Tuscola, Ill.	278	10-100
WEAF	New York, N. Y.	491.5	5000
WEAI	Ithaca, N. Y.	254	500
WEAM	North Plainfield, N. J.	261	250
WEAN	Providence, R. I.	270	500
WEAO	Columbus, Ohio	293.9	500
WEAR	Cleveland, Ohio	389.4	750
WEAU	Sioux City, Iowa	275	100
WEBC	Superior, Wis.	242	100
WEBD	Anderson, Ind.	246	15
WEBE	Cambridge, Ohio	234	10
WEBH	Chicago, Ill.	370.2	2000
WEBJ	New York, N. Y.	273	500
WEBL	New York, N. Y.	226	100
WEBQ	Harrisburg, Ill.	226	10
WEBR	Buffalo, N. Y.	244	100
WEBW	Beloit, Wis.	268	500
WEBZ	Savannah, Ga.	263	50
WEEI	Boston, Mass.	348.6	500
WEHS	Evanston, Ill.	202.6	10
WEMC	Berrien Springs, Mich.	285.5	500
WENR	Chicago, Ill.	266	1000
WEW	St. Louis, Mo.	248	1000
WFAA	Dallas, Texas	475.9	500
WFAM	St. Cloud, Minn.	273	10
WFAV	Lincoln, Nebr.	275	500
WFBC	Knoxville, Tenn.	250	50
WFBD	Philadelphia, Pa.	234	5
WFBE	Seymour, Ind.	226	10
WFBG	Altoona, Pa.	278	100
WFBH	New York, N. Y.	273	500
WFBJ	Collegeville, Minn.	236	100
WFBL	Syracuse, N. Y.	252	100
WFBM	Indianapolis, Indiana	268	250
WFBR	Baltimore, Md.	254	100
WFBZ	Galesburg, Ill.	254	20
WFDF	Flint, Mich.	234	100
WFI	Philadelphia, Pa.	394.5	500
WFKB	Chicago, Ill.	217.3	500
WFRL	Brooklyn, N. Y.	205.4	100
WGAL	Lancaster, Pa.	248	10
WGBB	Freeport, N. Y.	244	100
WGBC	Memphis, Tenn.	278	10
WGBF	Evansville, Ind.	236	500
WGBI	Scranton, Pa.	240	10
WGBM	Providence, R. I.	234	30
WGBR	Marshfield, Wis.	229	10
WGBS	New York, N. Y.	315.6	500
WGBU	Fulford, Fla.	278	500
WGBX	Orono, Me.	234.2	500
WGCP	Newark, N. J.	252	500
WGES	Oak Park, Ill.	250	500
WGHB	Clearwater, Fla.	266	500
WGHP	Detroit, Mich.	270	1500
WGMU	Richmond Hill, N. Y.	236	100
WGN	Chicago, Ill.	302.8	1000
WGR	Buffalo, N. Y.	319	750
WGST	Atlanta, Ga.	270	500
WGY	Schenectady, N. Y.	379.5	5000
WHA	Madison, Wis.	535.4	750
WHAD	Milwaukee, Wis.	275	500
WHAM	Rochester, N. Y.	278	100
WHAP	New York, N. Y.	240	500
WHAR	Atlantic City, N. J.	275	500
WHAS	Louisville, Ky.	399.8	500
WHAV	Wilmington, Del.	266	100
WHAZ	Troy, N. Y.	379.5	1000
WHB	Kansas City, Mo.	365.6	500
WHBA	Oil City, Pa.	250	10
WHBC	Canton, Ohio	254	10
WHBD	Bellefontaine, Ohio	222	20
WHBF	Rock Island, Ill.	222	100
WHBG	Harrisburg, Pa.	231	20
WHBH	Culver, Ind.	222	100
WHBJ	Fort Wayne, Ind.	234	50
WHBL	Chicago, Ill.	215.7	50
WHBM	Chicago, Ill.	215.7	20
WHBN	St. Petersburg, Fla.	238	10
WHBP	Johnstown, Pa.	256	100
WHBQ	Memphis, Tenn.	233	50
WHBU	Anderson, Ind.	218.8	10
WHBW	Philadelphia, Pa.	215.7	100
WHBY	West De Pere, Wis.	250	50
WHDI	Minneapolis, Minn.	278	500
WHEC	Rochester, N. Y.	258	100
WHK	Cleveland, Ohio	272.6	1000
WHN	New York, N. Y.	361.2	500
WHO	Des Moines, Iowa	526	5000
WHT	Deerfield, Ill.	238	3500
WIAD	Philadelphia, Pa.	250	100
WIAS	Burlington, Iowa	254	100
WIBA	Madison, Wis.	236	100
WIBG	Elkins Park, Pa.	222	50
WIBH	New Bedford, Mass.	209.7	30
WIBI	Flushing, N. Y.	218.8	50
WIBJ	Chicago, Ill.	215.7	50
WIBM	Chicago, Ill.	215.7	10
WIBO	Chicago, Ill.	226	1000
WIBR	Weirton, W. Va.	246	50
WIBS	Elizabeth, N. J.	202.6	10
WIBU	Poynette, Wis.	222	20
WIBW	Logansport, Ind.	220	100
WIBX	Utica, N. Y.	305.4	150
WIBZ	Montgomery, Ala.	231	10
WIL	St. Louis, Mo.	273	250
WIOD	Miami Beach, Fla.	247.8	1000
WIP	Philadelphia, Pa.	508.2	500
WJAD	Waco, Texas	352.7	500
WJAG	Norfolk, Nebr.	270	200
WJAK	Kokomo, Ind.	254	50
WJAM	Cedar Rapids, Iowa	268	100
WJAR	Providence, R. I.	305.9	500
WJAS	Pittsburgh, Pa.	275	500
WJAX	Jacksonville, Fla.	336.9	1000
WJAZ	Mount Prospect, Ill.	322.4	1500
WJBA	Joliet, Ill.	206.8	50
WJBB	St. Petersburg, Fla.	254	10
WJBC	La Salle, Ill.	234	100
WJBI	Red Bank, N. J.	218.8	250
WJBK	Ypsilanti, Mich.	233	10
WJBL	Decatur, Ill.	270	500
WJBO	New Orleans, La.	268	100
WJBU	Lewisburg, Pa.	211.1	100
WJJD	Mooseheart, Ill.	370.2	500
WJR	Pontiac, Mich.	516.9	5000
WJY	New York, N. Y.	405.2	1000
WJZ	New York, N. Y.	454.3	Var.
WKAF	Milwaukee, Wis.	261	500
WKAQ	San Juan, P. R.	340.7	500
WKAR	East Lansing, Mich.	285.5	1000
WKAV	Laconia, N. H.	224	50
WKBB	Joliet, Ill.	214.2	100
WKBE	Webster, Mass.	231	100
WKBG	Chicago, Ill.	215.7	100
WKRC	Cincinnati, Ohio	325.9 & 422.3	1000
WKY	Oklahoma City, Okla.	275	100
WLAL	Tulsa, Okla.	250	100
WLAP	Louisville, Ky.	275	20
WLB	Minneapolis, Minn.	277.6	500
WLBL	Stevens Point, Wis.	278	500
WLIB	Elgin, Ill.	302.8	4000
WLIT	Philadelphia, Pa.	394.5	500
WLS	Crete, Ill.	344.6	5000
WLSI	Cranston, R. I.	440.9	500

The complete list of broadcast stations, arranged for convenient reference appears every fourth month in SCIENCE AND INVENTION, with revisions and changes up to the closing date of the magazine. The first number after the call letters of the station is the wave-length of the station, expressed in meters; and the second number its power, expressed in watts.

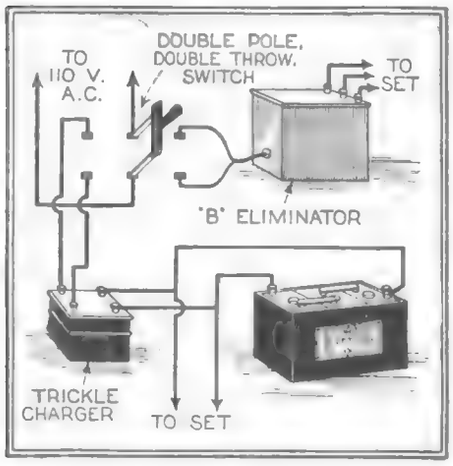
(*Continued on page 254*)

RADIO ORACLE

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

BATTERY AND CHARGER CONNECTIONS

(476) Q. 1. Richard Nicholson, Atlanta, Ga., asks: How should a double-pole, double-throw switch be connected for controlling a "B" eliminator and trickle charger?



Q. 476. Connections for a storage battery, trickle charger, and "B" eliminator, all controlled by means of a D.P.D.T. switch, are shown above.

A. 1. The diagram of connections requested is given above in this column.

T. R. F. AND REGENERATION

(477) Q. 1. H. H. Arfsten, San Francisco, Calif., wishes to know if it is practicable to add three stages of tuned radio frequency to his present three-tube three-circuit regenerative receiver.

A. 1. We would not advise you to attempt to construct a receiver of the type you mention. A combination of regeneration with three stages of radio frequency amplification is such that it is almost impossible to control it. We would suggest that if you desire to experiment with a set using three stages of tuned radio frequency amplification, you try something similar to the Bremer-Tulley Counterphase Six described in the April issue of SCIENCE AND INVENTION Magazine. This will give you excellent results. In case you desire to retain the regenerative feature and also want to have a consistently working receiver, we would advise you to build one similar to that described in the March, 1926, issue of this magazine. The item referred to is headed, "The Radio Constructor."

LONG LOUD SPEAKER LINE

(478) Q. 1. Maurice Harris, Cleveland, Ohio, says that he has installed an extra loud speaker in his home. The new unit is connected to the set by means of a pair of annunciator wires about 75 feet long. He gets very low volume and sizzling noises with the speaker at the distant end of the line, despite the fact that it works perfectly when connected directly to the set. He desires to know the remedy for this condition.

A. 1. A parallel pair of wires of any length have a considerable capacity between them, besides acting as a pick-up for radio frequency and telephone currents which cause disturbing noises in the loud speaker. We would suggest that you use a twisted pair of wires such as employed in telephone work in place of the parallel annunciator wires. In a twisted pair, the capacity effect is neutralized to a great extent. A radio frequency choke connected in series with the speaker may also aid in clearing up the extraneous noises. The best idea is to use lead-covered wire, and to ground the lead sheath.

ACTION OF AMPERITE

(479) Q. 1. James W. Otto, Pasadena, Calif., desires to have explained the action of the "Amperite" automatic filament current controlling devices.

A. 1. This automatic rheostat consists essentially of several turns of wire made of a metallic alloy, the resistance of which increases with the temperature. If the voltage of the battery is high, a large current will tend to flow through the "Amperite" and through the tube filament. This raises the temperature of the "Amperite," thus increasing its resistance. The increased resistance cuts the flow of current down to the proper value. As the voltage of the battery drops, due to continued usage, the flow of current will tend to become smaller, but this decreases the temperature, and consequently, the resistance, of the "Amperite," and the value of the current will remain almost normal.

RENEWAL OF TUBES

(480) Q. 1. M. W. Mason, Chicago, Ill., asks: How can 201A or 199 tubes which have become weak be brought back to their original activity?

A. 1. This may be accomplished by what is known as "flashing" the filament of the tube by a voltage greater than the normal operating voltage. For 201A tubes proceed as follows: With the "B" battery disconnected, apply 14 volts to the filament for a period of 30 seconds. Then, 7 volts for 10 minutes. For the 199 tube, apply 9 volts for 30 seconds and 4 volts for 10 minutes. The high voltage applied to the filament of the tube acts upon the thorium and brings it to the surface of the filament. If the tube is not too far gone, this process will, in many cases, restore it to its original activity.

MICROPHONIC HOWL

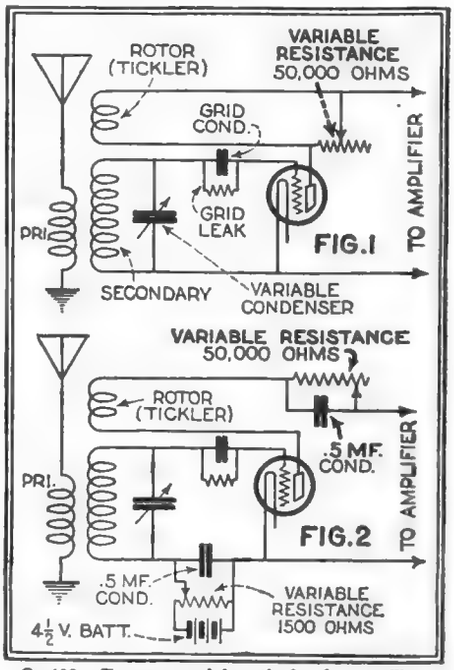
(481) Q. 1. Daniel Richardson, Jersey City, N. J., states that his set has a tendency to howl frequently. He describes this howl as follows: The sound is of an even pitch but starts from a bare audibility and builds up gradually to a deafening volume. He desires to know the cause of this and also the remedy.

A. 1. The howl you mention is in all probability due to the fact that you have one or more microphonic tubes in your set, that is, tubes which are sensative to vibration. You may remedy this condition in any one of the following ways. Try changing the tubes around in your set or replace them. Mount the tube sockets on sponge rubber, cork or felt. Place the loud speaker as far away as possible from the set. The loud speaker in all probability is the real cause of your trouble, since the sound from the speaker vibrates the tubes and produces the howl. If it is not practical to place the loud speaker at any distance from the set, then place a pad of felt or sponge rubber underneath the speaker base. This trouble is particularly noticeable when using UV199 tubes in super-heterodynes, unless resilient sockets are employed.

REGENERATION CONTROL

(482) Q. 1. Lyman J. Howe, Passaic, N. J., wants to know: How may the regeneration on a three-circuit set be controlled?

A. 1. Regeneration may be controlled by placing a variable resistance across the tickler coil as shown in Fig. 1. In order to give smoother reception, however, we would suggest that you employ the scheme shown in Fig. 2



Q. 482. Two successful methods of controlling regeneration are shown. The by-pass condensers make for smoother operation.

LIST OF BROADCAST STATIONS IN THE UNITED STATES

(*Continued from page 253*)

Radio Call Letter	BROADCAST STA. Location	Wave (Meters)	Power (Watts)
WLTS,	Chicago, Ill.	258	100
WLW,	Harrison, Ohio	422.3	500-5000
WLWL,	New York, N. Y.	288.3	3500
WMAC,	Cazenovia, N. Y.	275	100
WMAF,	Dartmouth, Mass.	440.9	1000
WMAK,	Lockport, N. Y.	266	500
WMAL,	Washington, D. C.	212.6	100
WMAN,	Columbus, Ohio	278	50
WMAQ,	Chicago, Ill.	447.5	1000
WMAY,	St. Louis, Mo.	248	100
WMAZ,	Macon, Ga.	261	500
WMBB,	Chicago, Ill.	250	500
WMBC,	Detroit, Mich.	256.4	100
WMBF,	Miami Beach, Fla.	384.4	500
WMC,	Memphis, Tenn.	199.7	500
WMCA,	Hoboken, N. J.	340.7	500
WNAB,	Boston, Mass.	250	100
WNAC,	Boston, Mass.	280.2	500
WNAD,	Norman, Okla.	254	500
WNAL,	Omaha, Nebr.	258	50
WNAT,	Philadelphia, Pa.	250	100
WNAX,	Yankton, S. Dak.	241	100
WNBH,	New Bedford, Mass.	248	100
WNJ,	Newark, N. J.	272	150
WNOX,	Knoxville, Tenn.	268	100
WNRC,	Greensboro, N. C.	224	10
WNYC,	New York, N. Y.	526	1000
WOAI,	San Antonio, Tex.	394.5	2000
WOAN,	Lawrenceburg, Tenn.	282.8	500
WOAW,	Omaha, Nebr.	526	1000
WOAX,	Trenton, N. J.	240	500
WOC,	Davenport, Iowa	483.6	5000
WOCL,	Jamestown, N. J.	275.2	15
WODA,	Paterson, N. J.	224	250
WOI,	Ames, Iowa	270	750
WOK,	Homewood, Ill.	217.3	5000
WOKO,	New York, N. Y.	263	50
WOO,	Philadelphia, Pa.	508.2	500
WOOD,	Grand Rapids, Mich.	242	500
WOQ,	Kansas City, Mo.	278	1000
WOR,	Newark, N. J.	405.2	500
WORD,	Batavia, Ill.	275	5000
WOS,	Jefferson City, Mo.	440.9	500
WOWL,	New Orleans, La.	270	10
WOWO,	Fort Wayne, Ind.	227	500
WPAK,	Agricultural Col., N. Dak	275	50
WPCC,	Chicago, Ill.	258	500
WPDQ,	Buffalo, N. Y.	265.4	50
WPG,	Atlantic City, N. J.	299.8	500
WPRC,	Harrisburg, Pa.	215.7	100
WPSC,	State College, Penna.	261	500
WQAA,	Parkesburg, Pa.	220	500
WQAC,	Amarillo, Tex.	234.2	100
WQAE,	Springfield, Vt.	246	50
WQAM,	Miami, Fla.	263	100
WQAN,	Scranton, Pa.	250	100
WQAO,	New York, N. Y.	360	100
WQJ,	Chicago, Ill.	447.5	500
WRAF,	Laporte, Ind.	224	100
WRAK,	Escanaba, Mich.	256.3	100
WRAM,	Galesburg, Ill.	244	100
WRAV,	Yellow Springs, Ohio	263	100
WRAW,	Reading, Pa.	238	10
WRAX,	Gloucester City, N. J.	268	500
WRBC,	Valparaiso, Ind.	278	500
WRC,	Washington, D. C.	468.5	1000
WRCO,	Raleigh, N. C.	252	100
WREC,	Coldwater, Miss.	254	10
WREO,	Lansing, Mich.	285.5	500
WRHF,	Washington, D. C.	256	50
WRHM,	Minneapolis, Minn.	252	50
WRK,	Hamilton, Ohio	270	100
WRM,	Urbana, Ill.	273	500
WRMU,	Richmond Hill, N. Y.	236	100
WRNY,	New York, N. Y.	258.5	500
WRR,	Dallas, Tex.	246	500
WRST,	Bay Shore, N. Y.	215.7	250
WRVA,	Richmond, Va.	256	1000
WRW,	Tarrytown, N. Y.	273	500
WSAI,	Mason, Ohio	325.9	5000
WSAJ,	Grove City, Pa.	229	250
WSAN,	Allentown, Pa.	229	100
WSAR,	Fall River, Mass.	254	100
WSAX,	Chicago, Ill.	268	100
WSAZ,	Pomeroy, Ohio	244	50
WSB,	Atlanta, Ga.	428.3	1000
WSBC,	Chicago, Ill.	209.7	1000
WSBF,	St. Louis, Mo.	273	250
WSBT,	South Bend, Ind.	275	250
WSDA,	New York, N. Y.	263	250
WSKC,	Bay City, Mich.	261	100
WSM,	Nashville, Tenn.	282.8	1000
WSMB,	New Orleans, La.	319	500
WSMH,	Owosso, Mich.	240	20
WSMK,	Dayton, Ohio	275	500
WSOE,	Milwaukee, Wis.	246	500
WSRO,	Hamilton, Ohio	252	100
WSSH,	Boston, Mass.	261	100
WSUI,	Iowa City, Iowa	483.6	500
WSVS,	Buffalo, N. Y.	218.8	50
WSWS,	Wooddale, Ill.	275	100
WTAB,	Fall River, Mass.	256	100
WTAD,	Carthage, Ill.	236	50
WTAG,	Worcester, Mass.	268	500
WTAL,	Toledo, Ohio	252	10
WTAM,	Cleveland, Ohio	389.4	2500
WTAP,	Cambridge, Ill.	242	50
WTAQ,	Eau Claire, Wis.	254	100
WTAR,	Norfolk, Va.	261	100
WTAW,	College Station, Texas	270	500
WTAX,	Streator, Ill.	231	50
WTAZ,	Lambertville, N. J.	261	15
WTIC,	Hartford, Conn.	475.9	500
WWAD,	Philadelphia, Pa.	250	250
WWAE,	Plainfield, Ill.	242	500
WWAO,	Houghton, Mich.	263	250
WWGL,	Richmond Hill, N. Y.	212.6	500
WWI,	Dearborn, Mich.	266	500
WWJ,	Detroit, Mich.	352.7	1000
WWL,	New Orleans, La.	275	100

Scientific Humor

YOU CAN FEEL YOURSELF GETTING RUN OVER

"How do you like your new car?" asked Diggs.

"Great," replied Biggs. "It runs so smoothly, can't feel it. Not a bit of noise; you can't hear it. Perfect combustion, you can't smell a thing, and speed, why it whizzes so you can't see it."

"Must be some car," ventured Diggs. "Can't feel it, can't smell it, can't hear it, can't see it! How do you know it is there?" —*J. B. Marsters.*

A NEW MONIA (NOT MANIA)

IZZY: "What is the difference between ammonia and pneumonia?"

DIZZY: "Search me."

IZZY: "Why, ammonia comes in bottles and pneumonia comes in chests."—*Lambros D. Callimahos, Rep. No.* 3503.

WHICH EVER WAY THE WIND DOTH BLOW

I am in the U. S. Army and stationed in the Hawaiian Islands My own particular job is that of running our brigade radio station. Last year in camp on the north shore of Oahu I had succeeded one evening in tuning in KGO, Oakland, California, with very fair volume. Just at this time a Chinaman walked into my tent looking both amazed and interested, so I offered him the phones.

"What dat?" he asked on first hearing the music.

I told him, explaining that it was 2,000 miles distant and that it took six days to get there by steamer.

"Which way is Oakland?" he inquired.

Makng a hasty calculation I pointed in the direction I considered Oakland to be.

"Aw!" he replied in his pidgin English, "how you get day way, you say Oakland over dere and wind blow dis way."—*Sgt. Richmond F. Howard.*

PERFECT TEST FOR GOLD

IRATE MOTHER: "Why Johnny, all the goldfish are dead."

JOHNNY: (chemistry student) "Those were not *gold* fish mom, or that sulphuric acid that I poured into the bowl wouldn't have affected them.—*Raymond F. Costello.*

COOTIES FED UPON THE HOSTS IN THE WORLD WAR

BIOLOGY TEACHER: "A parasite is a plant or animal which feeds upon its host, at the latter's expense."

STUDENT: "Is a cannibal a parasite?"—*Isadore Schwartz,* Rep. No. 22823.

AND THIS JOKE IS RESTIVE-FOR-US

A tiger is carnivorous: a cow is herbivorous; man is omnivorous, but some people I know are pestivorous.—*Edward Onhalt.*

FIRST PRIZE $3.00
YOUR WIFE MUST HAVE ONE!

MRS. NEWLYWED (as ambulance takes her husband out): "I knew if I kept that old chemistry book around here I would get it mixed up with the cook book."—*R A. Marks, Jr.*

JOHNNY WAS NOT DE-COY-ONE

TEACHER (In biology class after study of the stem of a tree): "Pupils, can any of you tell me what the wood ducts are?"

JOHNNY (the hunter—from back in the hall): "I know, wood ducts are decoys."
—*Goetze Jeter.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

WE PUT IT IN CUPS

JIMMY: "I got Greece on the radio last night."

JOE: "That's nothing, I got grease on my clothes Sunday."—*Fred Barta, Jr.*

HOW OLD ARE YOU NOW?

STUDENT: "How long could I live without brains?"

PROF.: "That remains to be seen."—*Lorena Skinner.*

THOSE WHO HAVE SEEN THEM BELIEVE THIS STORY

"What made Jones mount the water wagon?"

"His bootlegger had been selling alcohol that he stole from the specimen jars in the reptile building of the museum and forgot to strain the snakes and spiders from the last lot."—*John H. Spicer.*

SIC 'EM DOGWOOD

Mike had worked so long in the lumber yard that he could tell the wood by it's smell. One day Shorty, his companion, bet him five dollars that he couldn't. So they blindfolded Mike and held the wood about a foot from Mike's nose. After Mike had named all the wood in the yard and Shorty seeing he was going to lose looked around and saw a black cat. He grabbed it and held it about a foot from Mike's nose. Mike sniffed and sniffed again; at last he said, "You can't fool me Shorty, that's pussy willow."—*Philip R. Engels, Jr.*

JUDGING BY HIS FACE HE KNOWS NOTHING

SHE: "Do you know anything about surgery?"

HE: "Oh yes, I shave myself."—*John Warmuth.*

A WET BLANKET

A man once married a woman, and because of her fiery temper he called her "Combustion." As he failed to provide her with a healthy payroll, she called him "Chlorine." You see, chlorine does not support combustion.—*E. J. McFarland.*

AM ION?—I HOPE YOU ARE

PROFESSOR: "Can anyone tell me what an ion is?"

Only one boy raised his hand.

PROFESSOR: "All right, John, tell us."

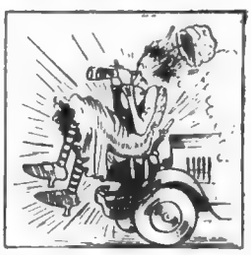
JOHN: "An ion is a shocked atom.—*Neal Morchouse.*

DEGREE OF S.S. (SING-SING)

IRATE PROFESSOR (who has just been arrested): "I'll have you understand that I'm a man of two degrees."

OFFICER: "It's all right, we'll give you the third!"—*William A. Heitler.*

EINSTEIN REFUTED!



LADY: "Are you sure these field glasses are high power?"

AMBITIOUS SALESMAN: "Madam, when you use these glasses anything less than ten miles away looks as if it were behind you!"—*Fred Kohler, Jr.*

ON THE LEVEL?

SMITH: "Last night I heard some fellow from Station WRNY play "Falling Waters," on a saw, with guitar accompaniment."

JONES: "How did it sound?"

SMITH: "Sounded as if the saw got a little rusty towards the end and it mitre been a litle more plane."—*Noel Compton.*

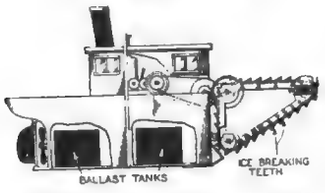
WERE THEY HARD- OR SOFT-BOILED

A maid was told to boil the eggs for reakfast for three minutes by her employer's watch.

She did. A jeweler had to repair the watch.—*Elizabeth Andrews.*

LATEST PATENTS

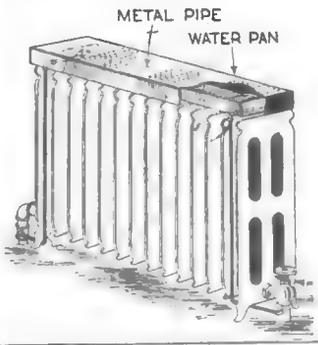
Ice Breaker



No. 1,482,511 issued to John Albert Ellis describes a machine designed to facilitate the breaking of ice in navigable water ways. It is built on the caterpillar principle with solid iron gripping and breaking teeth mounted on endless chains, and in such a way that the weight of the teeth, when in operation, will be reinforced by forward moving power and weight of the boat. As the endless chains are operated they first grip the ice and draw the full weight of the boat against it as they traverse, thereby subjecting the ice to tremendous pressure from above and at the edge.

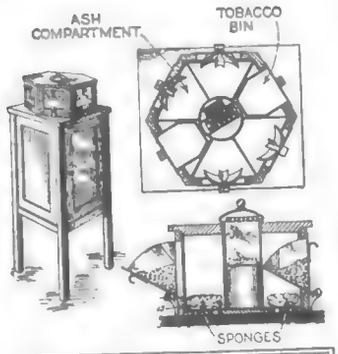
Air Moistener

No. 1,573,956 issued to Michael F. Weidenbach relates to an accessory for hot water and steam radiators for moistening the air by evaporating the proper amount of water. Evaporation is accelerated to the proper rate by providing within the pan containing the water, a heating pipe or coil arranged to receive hot water or steam from the circulating pipes of the heating system. With one filling of this arrangement from 10 to 15 gallons of water, the amount usually required for the average dwelling, are evaporated. With a pan of water simply placed on top of a radiator, only a very slight amount of water is evaporated.

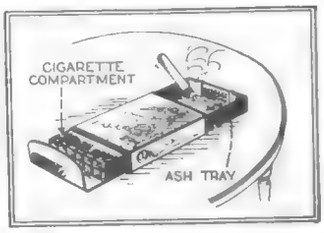


Smoker's Stand

No. 1,560,538 issued to Leo E. Cooke, relates to a device which serves efficiently as an ash tray, a tobacco receptacle, a cigarette holder, and which provides convenient storage space for cigars. A further object of the invention is to provide individual receptacles for ashes and discarded cigar or cigarette butts. The receptacles are made practically smoke proof so as to prevent the smoke from escaping into the room. The ashes which accumulate in the tray are automatically deposited in a large compartment when the doors of the smoking stand are closed.

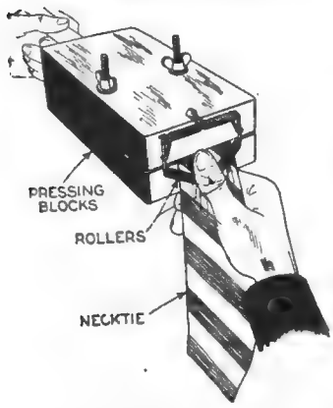


Cigarette Case and Ash Tray



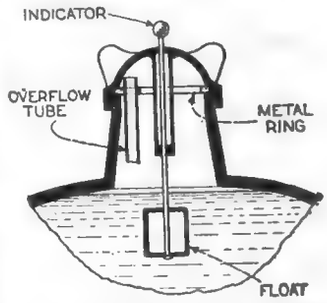
No. 1,562,497 issued to William Roberts Derry describes a combination cigarette container and ash tray. It aims to provide a means whereby an ash tray is associated with a pack of cigarettes of the ordinary type in such a way that when not in use the case will have all the compact features of the ordinary cigarette package. The ash tray does not interfere with accessibility to the cigarettes.

Necktie Presser



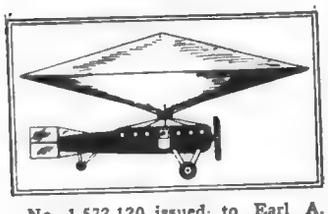
No. 1,576,542 issued to L. Z. Phillips describes a simple device for removing wrinkles from, and pressing neckties with a minimum expenditure of time and effort.

Radiator Cap



No. 1,574,486 issued to Claes Johnson presents an improvement in automobile radiator overflow alarm. The invention consists of a float fastened to an indicator which depends from the top of the radiator cap. When the water in the radiator expands the indicator is pushed up and when the water is too low the indicator is flush with the radiator cap.

Flying Machine



No. 1,572,120 issued to Earl A. Parker, and Claude W. Massingham protects a new type of lighter than air flying machine, so constructed as to be especially stable and efficient in flight under abnormal conditions, such as during storms.

Note—This Contest Was Announced In the June Issue

$300.00 IN PRIZES

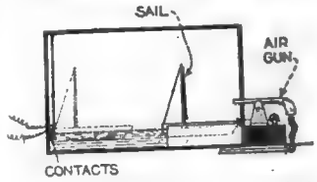
Conditions and Rules of the Board Contest

1. This contest is freely open to all, whether subscribers or not. From the contest are excluded employees of the Experimenter Publishing Company and their families.
2. Models of the prize entries are not to be sent in unless the contestant is requested to do so by the editors in writing.
3. An entry consists of three photographs, not smaller than 5 by 7 inches, printed on glossy paper, one complete pen-and-ink drawing, giving full dimensions of the article, and a description of the article in 500 words or less.
4. Photographs, drawings, and manuscripts must all be sent in flat. Rolled entries will be rejected.
5. Penciled matter can not be considered. Use ink or typewriter.
6. As many entries as desired can be sent in to the contest. There is no limit to the number of entries accepted from each contestant.
7. From this contest are excluded mere ideas and designs only, for the reason that this contest was inaugurated to stimulate the building of the actual models. Entries without photographs of the constructed articles are, therefore, not eligible.
8. The prizes will go to those who submit the most practical and useful ideas of how to build various "useful" articles from the wooden board. The editors reserve the right to send for any one of the entries by paying transportation charges both ways.
9. This contest closes at noon, July 10th, 1926, at which time all entries must be in the hands of the judges in order to qualify.
10. Should two or more contestants submit the same prize-winning idea, a prize identical to that offered will be given to each of those contestants so tying.
11. Address all entries to Editor, WOODEN BOARD CONTEST, c/o SCIENCE AND INVENTION, 53 Park Place, New York City.

$300.00 IN PRIZES

First Prize	$75.00
Second Prize	50.00
Third Prize	35.00
Fourth Prize	25.00
Fifth Prize	20.00
Sixth Prize	15.00
Seventh Prize	10.00
Eighth to 21st Prizes, inclusive $5.00 each	70.00
	$300.00

Amusement Device



No. 1,499,875 issued to Joseph Rosenheim. Model sailboats are held at their wharves in a tank by means of small permanent magnets. When the air is turned on the pressure of the wind against the sail drives the boat to the far end of the tank. The nose of the boat closes contacts operating the signalling device. The air is directed against the sail by the participants.

NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.

THE ORACLE

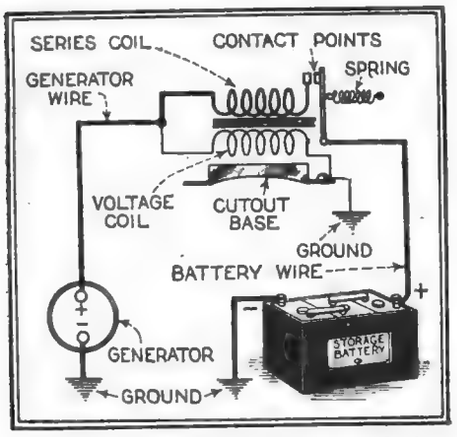
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

GENERATOR CUTOUT

(2065) Q. 1. Ralph R. Mason, Racine, Wis., asks: When a storage battery is being charged by a generator, how is the cut-out wired in the circuit and how does it operate?

A. 1. The diagram given in these columns shows how such a cut-out is wired to the generator and to the storage battery to be charged. The cut-out of the usual type has two windings. Its purpose is to prevent the battery from discharging through the generator in case the motive power of the generator should fail or should slow up to a point where the generator is not being turned over fast enough to supply sufficient voltage to charge the battery. When the correct speed for the operation of the generator is attained, the current flowing through the voltage coil, which is wound with fine wire, will pull the armature toward the core and close the contact points. The battery will then be charged through the series coil. If, however, the voltage in the generator falls off to a point where the battery starts to discharge through the windings, the current from the battery flowing backward through the series coil will set up an opposing current to that traveling through the voltage coil, and the result will be to demagnetize the core and allow the spring to pull the armature back, opening the circuit at the contact points. Thus the battery is prevented from discharging.



Q. 2065. The method of wiring the coils in the generator cut-out is shown in the above diagram. If the voltage of the generator gets too low, the contacts open, thus preventing the battery from discharging through the generator.

SOLAR MOVEMENT

(2066) Q. 1. Richard L. Mason, Lincoln, Nebraska, says that he has been told that the entire planetary system, including the sun, the planets, asteroids and satellites, is moving through space. He asks: Is this true and if so, what is the rate and direction of the movement?

A. 1. The entire system is moving through space at a speed calculated at 12 miles per second. The direction of the movement is very nearly toward Vega in our northern sky.

PHOTOGRAPHIC QUERIES

(2067) Q. 1. Albert Berkman, Roscoe, N. Y., asks: What is the best method of photographing stone memorial tablets. I find great trouble in bringing out the detail of the lettering.

A. 1. It is of course necessary that the surface first be clean and free from accumulation of dirt and dust. Then photograph the stone or tablet with a strong side light. It is occasionally found that moistening the surface of a stone tablet will bring out indistinct lettering.

Q. 2. How can hollow silverware be photographed without the usual glare that is found when no precautions are taken?

A. 2. Probably the best method of accomplishing this work satisfactorly is to fill the vessel with ice or very cold water whereupon, in a warm room, the outer surface of the vessel will become covered with a film of moisture which will kill and prevent all reflections.

Q. 3. In photographing coins, it is very difficult to bring out the details. How can this work be accomplished?

A. 3. One very good method is to first smoke the surface of the coin with a burning magnesium ribbon which leaves a fine white film on the surface. Then photograph the object using a very strong side light so as to throw the figures and lettering into strong relief.

INK REMOVER

(2068) Q. 1. Clarence L. Persons, Kimball, Wis., requests a formula for making a liquid ink remover.

A. 1. An ink remover that will prove satisfactory for most inks can be made by mixing citric acid and alum. This is then made into a liquid with water and applied to the ink spot. If the ink is on a cloth or woven fabric, the liquid should be rubbed into the fabric and then washed out with water.

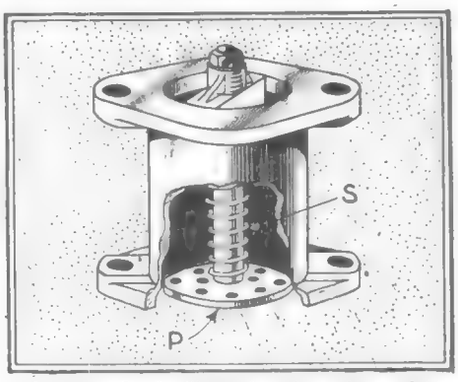
SOUND

(2069) Q. 1. Margaret Flanagan, New York City, asks: Does the pressure of the atmosphere have any effect on the speed of the travel of sound?

A. 1. Air pressure has no effect on the velocity of sound traveling through it, providing the temperature remains constant. If, however, the temperature rises or falls, the speed of sound through it increases or decreases at a rate of about 2 feet per second per degree Centigrade change in temperature.

GOVERNOR

(2070) Q. 1. James L. Harris, Washington, D. C., inquires: How does a suction type of governor for automobile trucks operate?



Q. 2070. In the illustration above the suction in the intake manifold causes the piston, P, to **decrease the effective size of the manifold. The engine is thus prevented from attaining too great a speed.**

A. 1. The illustration in these columns shows the action clearly. A small piston is placed in the intake manifold of the engine and as the speed of the engine increases, the increased suction in the manifold causes the piston, P, to rise and compress the spring, S. Therefore, the opening of the manifold is constricted until at a maximum speed, controlled by the strength of the spring S, the engine cannot be further accelerated because of the fact that the supply of gas is cut off by the piston P, and only the gaseous mixture entering through the holes in the piston is available to operate the engine.

DIRIGIBLE DATA

(2071) Q. 1. Theo. C. Jimenez, Los Angeles, Calif., asks various questions relative to the weight and lifting power of the ill fated dirigible "Shenandoah."

A. 1. The following information has been supplied by our aeronautical expert, William P. Sullivan.

"No detailed reports have been given out on the exact structure weights of the "Shenandoah." It was 680 feet long and 76.78 feet diameter with a gas capacity of 21,148,000 cubic feet. The approximate weights are as follows:

Weight of frame	58,250 lbs.
Weight of envelopes	11,000 lbs.
Weight of motors and cars	7,800 lbs.
Total	77,050 lbs.

The ship had twenty gas cells, the outer and inner coverings being of gold-beaters skin, a substance fabricated from the outer skin of the blind gut of the ox. Material was taken from 900,000 oxen before sufficient was obtained to manufacture this covering.

The lifting power of hydrogen gas is as follows:

1 cu. ft. of air weighs .....1.293 k.g.
1 cu. ft. of hydrogen weighs..... .089 k.g.
1 cu. ft. hydrogen lifts .....1.204 k.g.

35.31 cu. ft. lifts $1.2 \times 2.2046 = 2.65$ lbs.

1,000 cu. ft. lifts $\frac{1{,}000 \times 2.65}{35.31} = 75.0$ lbs.

Helium lifts 92 per cent. as much as hydrogen. Lift of helium gas 92% of 75.0 = 69 lbs. per 1,000 cu. ft.

Total lift of "Shenandoah" with helium, 150,212 lbs.

BROWNIAN MOVEMENT

(2072) Q. 1. Herbert Frisch, Mt. Vernon, N. Y., asks: What is the Brownian movement?

A. 1. This is a phenomenon that is found in colloidal solutions. By observing such a solution under a very powerful microscope, an English botanist, Brown, observed a constant irregular motion Investigation showed that the vibration was more lively as the particles decreased in size. The motion is one that never ceases and a theory has been advanced that it is caused by the incessant motion of the molecules of the liquid which thrust against the particle of suspended matter on all sides and drive it back and forth.

HUMIDITY

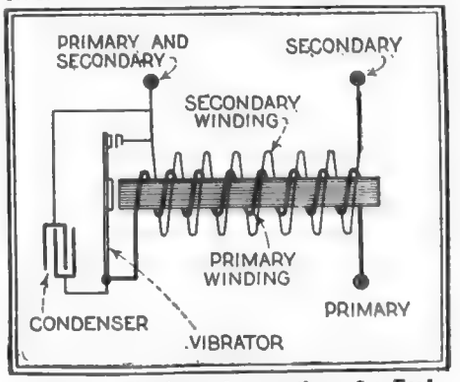
(2073) Q. 1. R. B. Young, Detroit, Mich., asks: Why is it that for a given degree of humidity the air feels damper in cold weather than it does in warm weather?

A. 1. The feeling of dampness of the air against the skin is due to the degree of saturation of the atmosphere with water vapor. Cold air becomes saturated with a smaller quantity of water than warm air and, therefore, for a given amount of water vapor in the atmosphere, cold air feels damper than warm air. For this reason it is desirable, for accuracy, to give relative humidity figures, relating the amount of water vapor in the atmosphere to the temperature.

FORD COILS

(2074) Q. 1. Charles Anderson, Astoria, L. I., wants to know: How is a Ford spark coil constructed? I find that it only has three terminals.

A. 1. The interior connections of a Ford spark coil hook-up is shown here. It will be noted that the primary and secondary have a common terminal which constitutes one of the contacts on the outside of the coil box, whereas the other two terminals are primary and secondary respectively, as indicated. A condenser is connected across the vibrator points.



Q. 2074. The internal connections of a Ford spark coil are simplified by using only three instead of the customary four terminals. One terminal is common to both the primary and secondary windings.

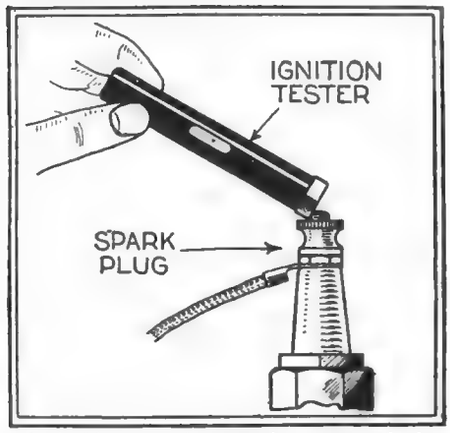
IGNITION TESTER

(2075) Q. 1. Richard King, St. Louis, Mo., asks: How is the ignition tester designed for use on automobiles and which incorporates a gas-filled tube supposed to be used?

A. 1. The illustration in these columns shows such an ignition tester and the following rules for use can be applied:

If no flash is seen in the tube when the copper end is touched to the spark plug, look for a completely shorted and fouled plug. It is also possible that there is no current getting to the plug.

If the gauge is slowly withdrawn from the plug and the flashes in the tube continue to be visible at some distance from the metal part of the plug, this usually indicates that the porcelain or other insulation of the tube is broken.



An ignition tester incorporating a neon tube is a very handy adjunct for the automobilist to have with him at all times. It is used for detecting ignition troubles and the various ways in which different troubles show up are fully and completely described in this column.

Very intense flashes in the indicator show that the gap between the points of the spark plug is too wide.

If the flashes overlap and are not clean-cut at each firing of the plug, look for leaks between the feed wires or for a fouling of the distributor.

If the flashes are very dim and irregular in action, either the spark plug is partially fouled or else the feed wires leading to the plug are leaking. Examine the plug and if the trouble is not here, look over the feed wires for defective insulation.

Regular and clean-cut flashes of light of medium brilliancy show that the spark plug under test is working in its correct manner.

MAGNETIC HELMET

(2076) Q. 1. H. C. Darrow, Brooklyn, N. Y., asks: Where can I purchase a magnetic helmet? I have been troubled with severe headaches and about ten years ago purchased a helmet containing a great number of small powerful magnets. I had the magnets recharged several times but the helmet does not work as well as it did.

A. 1. The magnetic helmet is of no benefit whatsoever. It is merely a fraudulent scheme for obtaining money. The device is about as efficient as an ordinary cloth hat. The small pieces of metal even though magnetized have no effect upon the human system.

Q. 2. What can I get to neutralize my personal magnetism if I cannot get another magnetic helmet?

A. 2. Don't believe this sort of bunk. The magnetic cap has not changed your "personal magnetism" (even if such a thing exists) one single bit. The terms "personal magnetism" have been coined by some writers who differ entirely as to their opinion of what the terms really mean. The trait is purely a characteristic of the individual and cannot be influenced by anything electrical or non-electrical. Your headaches are not due to an excessive amount of "personal magnetism." Our staff medical expert advises that you consult a physician.

LEANING TREES

(2077) Q. 1. Herbert Wolfe, Atwater, Ohio, says that during a recent trip through the tropics he observed in certain localities that the cocoanut palm trees showed a marked inclination from the vertical. In fact, some of them were inclined at such an angle that it was possible to walk upright along quite a portion of the entire length of the trunk. He asks: What could cause these trees to grow in this position?

A. 1. Undoubtedly this unusual growth is found only in localities where high winds prevail and where these winds usually pass over the land in approximately the same direction. Due to the comparatively constant pressure thus exerted against the trunks of the trees they would naturally tend to grow in an inclined position. Several authorities agree on this theory regarding such growths.

PREHISTORIC TOOLS

(2078) Q. 1. Clyde G. Hutchinson, Portland, Ore., asks: At what period in the history of man was record first found of the use of tools?

A. 1. The very earliest rough tools of which any trace has been found are said to have been made by man thousands of years ago at the beginning of what is now termed the Early Stone Age. They were made from small stones, portions of which had been chipped away in order to form a crude edge. This age was also known as the Paleolithic age. Later on these tools and weapons were more finely finished and polished, giving rise to what is known as the later Stone or Neolithic age.

BATTERY DISCHARGES

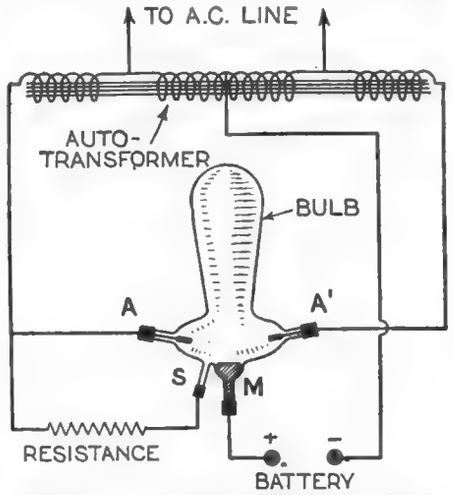
(2079) Q. 1. J. W. Robertson, Ont., Canada, says: The storage battery in my automobile continually goes dead even after it has been fully charged. This takes place even though the car is not in use at all. What could be the causes of such trouble?

A. 1. There are several places to look for this trouble. First, with all the lights and ignition switch turned off, remove one of the leads from the battery and connect a voltmeter in series with the heavy lead and the battery terminal. If the voltmeter registers, this shows a short-circuit or a ground somewhere in the wiring of the car, that must be traced out and located. If there is no indication on the voltmeter, the trouble is probably due to a poor battery, which may be internally short-circuited. If no current is found flowing in the circuit when the switches are all turned off, take your battery to your local service station and have it carefully looked over.

MERCURY ARC RECTIFIER

(2080) Q. 1. Lyman Strouble, Pasadena, Calif., asks: Kindly show a schematic diagram of a mercury arc rectifier and briefly describe the action.

A. 1. Such a rectifier is illustrated here. It has been found that a glass bulb containing mercury vapor will allow the flow of electric current in only one direction or from the anode to the cathode. The usual mercury arc rectifier such as the one illustrated here is designed for rectifying both halves of the A.C. wave by providing two



Mercury arc rectifiers are frequently employed for battery charging and in other places where it is desired to rectify an alternating current. The circuit above shows how one of these bulbs is hooked up in a standard circuit.

anodes, A and A1. It is of course necessary to start a rectifier of this nature and to provide the mercury vapor which makes it possible for the rectifier to operate. For this purpose, a starting point S is provided and connected to the line by means of the resistance indicated. The bulb is rocked so that mercury connects S with M and then the connection is broken. When this happens, ionized mercury vapor is provided from the cathode and this action continues as long as the current is passing from one of the two anodes to the cathode. In order to prevent the extinction of the arc at the end of each half cycle, large reactances are supplied in the lines.

DOG-FACED MAN

(2081) Q. 1. D. Stratford, Bridgeport, Conn., writes: I have been told that the dog-faced man at the circus is a cross between a man and a dog. Is this so?

A. 1. This condition is medically known as hypetrichosis. Your informant makes a statement which is absolutely ridiculous. A cross between man and animal cannot possibly occur.

ACID PROOFING

(2082) Q. 1. William Marks, Jersey City, N. J., asks: How can a good preparation be made that is to be used for coating boxes and other wooden parts that are occasionally subjected to the action of sulphuric acid, both concentrated and in solution?

A. 1. Apply the following mixture while warm to the wooden parts, 6 parts of wood tar and 12 parts of resin are melted together in an iron kettle after which 8 parts of finely powdered brick dust are stirred into the mixture. Do not apply this compound until the wooden surfaces have been thoroughly cleaned and dried.

WOOD ALCOHOL TEST

(2083) Q. 1. A. W. Swenson, Waverly, Iowa, refers to the test for wood alcohol published in the January, 1926, issue of this magazine and says that he has performed the experiment as outlined. Everything went along smoothly with the exception of the action of the fuchsine-bisulphite solution. This could not be made to change from red to colorless. He asks: Can you tell me how to complete this experiment satisfactorily inasmuch as I am very much interested in it?

A. 1. We have referred this matter to the author of the article under discussion, Mr. Raymond B. Wailes, and his reply is as follows:

"I believe the trouble which you had in making the solution colorless was due to impure fuchsine, the impurity being a dye of some sort which would not decolorize."

IS HYDROGEN EXPLOSIVE?

(2084) Q. 1. Leon Braverman, Passaic, N. J., asks: Is pure hydrogen inflammable?

A. 1. Pure hydrogen is neither inflammable nor explosive. If, however, it is mixed with air or oxygen, in the proper proportions, a highly explosive mixture will be formed. The smallest concentration of air mixed with hydrogen that can really be termed explosive is in the neighborhood of 36 per cent. of air. However, as small a quantity as 9 per cent. of air will form an inflammable mixture.

VACCINATING INFANTS

(2085) Q. 1. Mrs. V. Hartford, Rochester, N. Y., asks: Do you advise me to have my child vaccinated against small pox?

A. 1. Yes, by all means. In those countries or communities where vaccination is neglected, outbreaks of small pox occur.

Q. 2. Is eight months too young to start?

A. 2. Yes, in delicate children or children suffering from skin diseases, not otherwise.

Q. 3. Should she be vaccinated on the arm or the leg?

A. 3. In infants not yet walking or creeping the leg is preferred particularly if the baby is a girl. In older children the arm is generally the seat of the vaccination.

BATTERY GASES

(2086) Q. 1. Thomas M. Hayes, New York City, asks: What are the gases that are liberated during the charging of a storage battery after the voltage in the battery has reached a certain point?

A. 1. These gases are the same as those evolved by the decomposition of water by electricity, namely, oxygen and hydrogen. A little oxygen may be evolved at the positive plates and the hydrogen at the negative plates.

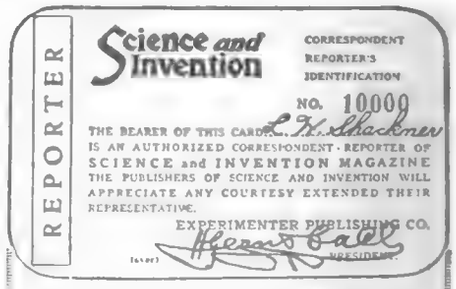
BICHLORIDE OF MERCURY FOR WOUND

(2087) Q. 1. Mr. G. B. Hiller, Newark, N. J., writes: An old sea captain has told me to use bichloride of mercury on a nasty wound I have on my foot, claiming that this treatment helped him out of a similar condition. Would you advise that I try bichloride of mercury?

A. 1. No. Bichloride of mercury should never be used on an open wound.

Q. 2. What should I use?

A. 2. Not knowing the nature of the wound we could not very well advise as to what procedure to follow. We would suggest that you go to a physician or to a hospital and have this treated properly.


REPORTER

Science and Invention

CORRESPONDENT REPORTER'S IDENTIFICATION

NO. 10000

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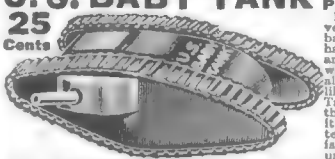

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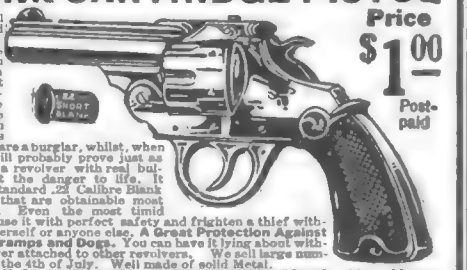

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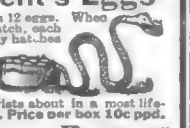
Serpent's Eggs



Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most lifelike manner. **Price per box 10c ppd.**

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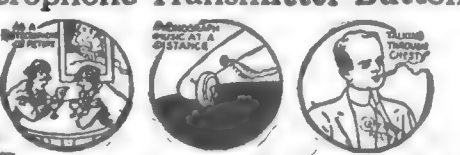

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You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is ultra-sensitive and is the greatest invention in micro-phones. You can mount the button almost anywhere—card board boxes, stove pipes, stiff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen-in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmitters; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. $5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. **PRICE $1.00 POSTPAID ANYWHERE.**

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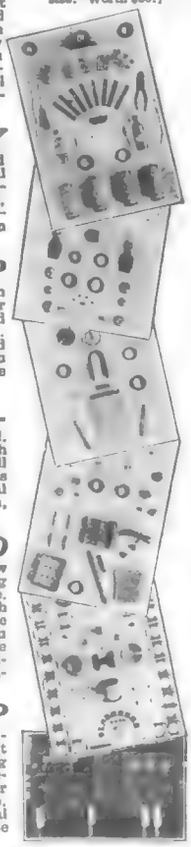

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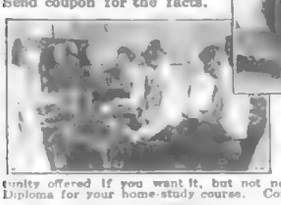

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Answers to the 12 Editorial Questions

THE twelve questions in Mr. Gernsback's editorial of this issue are answered in two sets. The first set immediately following is what may be termed a "popular" set of answers. A technical set, for the more technical reader, more accurate, follows the first set.

1—Materials used in the manufacture of lead pencils are wood, graphite and glue. No lead is used.

2—Static is a more or less violent atmospheric electrical disturbance.

3—Newspaper stock is made of macerated wood, commonly termed "wood pulp."

4—When an electric conductor becomes overloaded to a greater capacity than it can stand, it usually becomes disrupted with a loud report. This is popularily termed a "short-circuit." An analogy to a short-circuit is an automobile tire blown up beyond its capacity, when it blows out with a loud report. But you can have a short circuit without a blow out.

5—Day and night at the north and south poles are of equal length, namely six months day and six months night.

6—A magnet attracts the following metals: All iron, nickel, cobalt and manganese.

7—In a popular explanation, the difference between heat and cold may be explained by saying that a cold body merely indicates deficiency of heat.

8—Air is one of the best known retainers of heat. If the air is removed or greatly rarefied, heat can not be collected or stored readily on a given body. A mountain top is in rarefied air and radiates the heat more quickly than it retains it. This explains eternal ice on mountain tops.

9—Crude oil is a distillate of living creatures that roamed the earth and sea millions of years ago. Therefore it may be said to be an animal oil.

10—There is no difference between germs and bacteria. Both are living organisms which may be either poisonous or infectious or harmless.

11—A musical note is one that is melodious. The less overtones the note has, the purer it becomes musically. When you strike all the notes on the piano together, although each one is a separate musical note, the result will be a noise. A noise is a conglomeration of notes or sounds—in other words, an impure mixture of sounds.

12—According to the Mendelian Law, if all four grandparents have black or brown eyes, and all their children black eyes, the next generation will be born with black eyes. Brown- or dark-eyed parents can have blue-eyed offspring only if in the second previous generation there were blue eyes.

TECHNICAL ANSWERS TO QUESTIONS

No. 1.—The materials which go into the manufacture of a lead pencil are wood, graphite (not lead), glue, and in those pencils equipped with erasers, rubber and usually metal, other ingredients are found in the rubber.

No. 2.—Static is an atmospheric electrical disturbance and is now commonly applied to the noise heard in radio receiving sets. Sometimes these noises are not static but are produced by leaking transformers, X-ray apparatus, etc.

No. 3.—Newspaper stock is generally made of wood pulp, and wood pulp is made of logs sawed from trees from which the bark has been stripped, the logs are cut up, shaved up and then mashed and bleached. Paper stock has also been made of grasses and other products. Chemicals are added to the paper to give it body and to produce the glossy effect.

No. 4.—The term "short-circuit" is a broad one and it usually refers to the case where an electric conductor of relatively low resistance is accidentally or purposely connected across the opposite sides of an electric circuit, causing the current in that circuit to rise to ten or possibly one hundred times its normal value, the result being that the fuse or other protective devices open the circuit.

No. 5.—Day and night at the North and South poles are approximately six months in length, if we exclude the effects of refraction. The day starts when the sun shines exactly on the equator. That is on March 21st, and continues until September 21st at the North Pole and vice versa at the South Pole. At a latitude of 70 deg. the longest day and night is about two months each; 10 deg. further north another month is added to each day and night.

No. 6.—A magnet will attract annealed iron, tempered steel, cast-iron, cast-steel, platinum, wrought-iron, manganese steel, nickel, cobalt, and amongst the inorganic compounds, cobalt sulphate, copper sulphate, ferric chloride, ferrous sulphate, nickel sulphate, potassium bichromate, potassium ferrocyanide and liquefied oxygen and air.

No. 7.—The difference between hot and cold is one of molecular vibration, and the terms should always be used comparatively with some known scale. For instance, liquid air is cold in comparison with ice and will boil on ice, and the electric arc is hot when compared with boiling water or molten iron.

No. 8.—Mountain tops are colder than their bases because the radiant heat of the sun warms the earth and the atmosphere. The atmosphere acts as a blanket and retains the heat but on the mountain top it is rarefied and consequently does not retain heat. The height of the highest mountain is as nothing in comparison with the distance of the earth to the sun, and the apparent nearness of the mountain to the sun cannot be taken into consideration.

(*Continued on page 264*)

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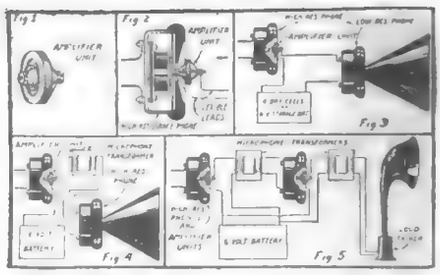

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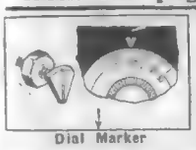

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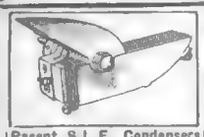

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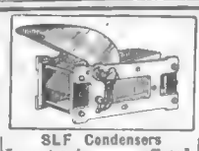
L4432 .00015 mf. 17-plate 3.95

L4433. .0005 mf. 23-plate $2.95



SLF Condensers

Lowest prices ever offered. Despite this low price, these condensers are made with precision aluminum stampings, hard rubber insulation. Money back if not satisfactory.

L3513 .00025 13 pl. $1.06
L3517 .00035 17 pl. 1.20
L3523 .0005 23 pl. 1.35

"Guaranteed" Vacuum Tubes

We consider the "Guaranteed" tube one of the best on the market. Any tube replaced if defective, providing filament lights. Calibrated curve goes with each tube.

L701A 5v. 0.25 amp. $1.25
L799 3 volt. .06 amp. 1.25

Audio Transformer

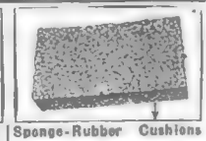
This is the famous Pacent Audioformer. Nickel case is grounded to base. Extra high degree of amplification. Minimum distortion and reaction. Binding posts and solder lugs. Ratio 3½ to 1.

L2811 Mounted type $4.50
L2812 Unmounted .. 3.15

Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils Silicon steel stampings used. Save 50 per cent by assembling it yourself.

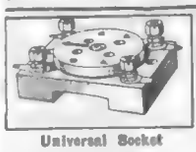
L1100 Ratio 4½-1 $1.40
L1150 Ratio 6½-1 1.00



Sponge-Rubber Cushions

Get rid of tube noises due to vibration. Softest sponge rubber made. Size 2½"x3", ⅜" thick.

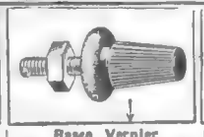
L8989 Sponge-rubber cushions, each $0.12
Six for 0.60



Universal Socket

Takes new "X" type tubes as well as old standard "UV" and "C" types. Made entirely of Isolantite. No capacity effect between plate and grid. New phosphor bronze wiping contacts. Standard mounting type.

L6514 $0.49



Rasco Vernier

Why use a vernier dial when a vernier attachment will do anything and everything a vernier dial accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.

L1450 Vernier $0.12

FONEKUSHIONS

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather. Sanitary.

L3550 Fonekushions, set of two $0.35

Dial Button

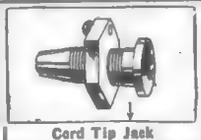
Made in blue enamel and gold, to be worn in button hole. Every radio fan wants one. ¾" diameter, best gold plate. Perfect reproduction of radio dial

L7799 Dial Button, Each $0.25

Vacuum Tube Shell

Nickel plated shell for the man who builds his own. 4 holes to attach to subbase. Each shell comes complete with 4 phosphor bronze socket contacts. See illus. 4748.

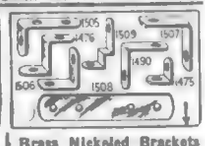
L4747 Vacuum Tube Shell and Contacts $0.16



Cord Tip Jack

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.

L1500 Cord tip jack, Each $0.15



Brass Nickeled Brackets

All Illustrations ¼ size.

L1505 Bracket, each $0.05
L1507 Bracket, each .05
L1509 Bracket, each .04
L1476 Bracket, each .05
L1508 Bracket, each .05
L1490 Bracket, each .04
L1475 Bracket, each .03
L1508 Bracket, each .05

Microvern

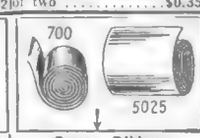
THE vernier dial for extra sharp tuning. No backlash. Special finish permits logging of stations on dial. Beautiful appearance. Comes in gold or silver finish. State which wanted.

L3066 Microvern, any finish $1.76

Rasco 180° Variocoupler

Silk wire wound on bakelite tubes. Six taps. Wave length, 150 to 600 meters. For panel mounting. ¼" shaft. Your money refunded if it is not all we claim.

L3100 Variocoupler prepaid $1.05



Copper Ribbon

.0005" thick.
L700 ⅜" wide; L701 ¼" wide; L702 3-16" wide.
All sizes per foot...$0.01

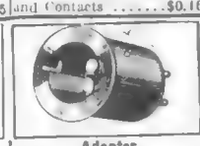
Copper Foil

.001" thick. 4" wide.
L5025 Copper Foil, per foot $0.10
10-foot length 0.80

Rasco Clip Leads

Invaluable for experimental work. Clip lead hooks in a jiffy onto any wire, binding post or conductor. Safest experimental connection. Brass clips, 1 foot silk wire, green or red.

L7887 Clip leads, ea $0.12
Dozen lot 1.35



Adapter

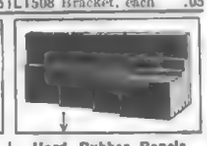
Pacent Improved Adapter. Takes 199-type tubes. Fits standard 201A sockets. Phosphor bronze springs, short circuits impossible. Bakelite molded.

L6521 Adapter $0.36

PUSH-PULL

Push Pull Transformer for many new circuits. See any radio magazine. Made of best materials. Coils impregnated. Silicon steel laminations. Save 50 per cent by assembling yourself. Simple instructions furnished.

L1159 Push-Pull Transformer ratio 6½ to 1 $2.95

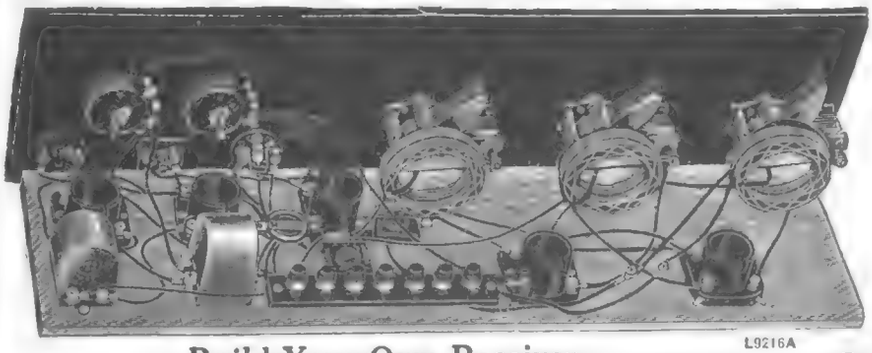


Hard Rubber Panels

Highest dielectric strength as per Bureau of Standards. Beautiful high finish.

L7100 7x10x3-16" $0.65
L7120 7x10x3-16" 0.79
L7140 7x14x3-16" 0.89
L7180 7x18x3-16" 1.15
L7210 7x21x3-16" 1.31
L7240 7x21x5-16" 1.46

RASCO 5-TUBE TUNED RADIO FREQUENCY RECEIVER $17.95



L9216A

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Revolutionary Improvement in Assembling Radio Sets

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No tools needed except a common screw-driver and common pliers.
All connections are made by the use of our flexible, insulated eyeletted connecting wire in place of bus bar or wire, and solder.
And in a fraction of the time usually required when building the old fashioned way. And when the job is done it is neat and your connections are tight.

We Furnish a Special Blueprint Free With Each Kit
Connections Always Perfect

PARTS INCLUDED IN THIS RECEIVER

Cabinet, mahogany finish, 7x26x8 .....$5.34
Panel, drilled and engraved, Bakelite-Dilecto, 7x26 ..... 3.50
Baseboard, laminated ..... .40
Coils, tuned transformers, our No. 2629..... 1.05
3 Variable condensers, .00038 Capacigrad @ $1.70 ..... 5.10
3 4-Inch Pilot Dials ..... .75
2 Transformers, audio frequency, Pacent @ $3.75 ..... 7.50
2 Rheostats, 20-ohm, Pilot ..... .92
Sockets, low loss, Bakelite, Pilot, @ 25c 1.25
Jack, single circuit improved ..... .50
Jack, double circuit improved ..... .70
Switch, A battery, Pacent ..... .36
Fixed grid condenser and mounting, Micamold .00025 ..... .35
Grid leak, 2 megohm, Pacent ..... .32
Fixed condenser, .002 mfd Micamold ..... .31
Fixed condenser, .005 Micamold ..... .44
Binding post strip, Rasco (with binding posts) .35
No-Sod-er connecting wires, full set 1.75
Necessary hardware, screws, angles, etc..... .25
Blueprint and instruction sheet 1.00

Total Price of Set.....$32.24
Our price, Catalog No. L9216.....$22.95
No. L9216A, same kit, but without cabinet..$17.95

BIGGEST VALUE IN AMERICA

If you wish the finest 5-tube set to be had, you have it in this model. No better set made in popular-priced receivers.

Low cost compared with results obtained.

This is not a small set thrown together with questionable parts that no one knows and made only to sell. All our parts are listed by name and are standard merchandise—nothing else.

This is a BIG SET, measuring 7 x 26 inches, and there is no one in the country today who can compete with us in this particular outfit.

Note particularly that the condensers which we use are brass plate condensers of the new straightline frequency type, not obsolete straight wave-length type, which are so hard to tune on the lower waves.

NEW ADJUSTABLE COILS (Patents Pending)

In this set we use adjustable coils, which can be moved up and down, away from the condenser, until the right balance is found. This makes for an unheard of and really incredible degree of sensitivity which has not been realized heretofore in sets of this kind.

Note also that the panel comes to you all drilled, with all holes drilled in position, and that any child can put together this wonderful receiver in less than an hour.

This set is highly efficient for bringing in the greatly-desired long range reception. 3,000 miles has been covered repeatedly. This has been accomplished by using two stages of tuned radio frequency with detector and two stages of audio frequency.

The tuning is done by three large dials; the first dial controls the antenna tuning, the center dial the first radio transformer, and the last dial the second radio transformer.

Make Big Money by assembling and selling them complete to friends and business houses who need a First Class Radio. Many of our customers sell these completed sets from $30.00 upwards.

New 1926 "Rasco" Catalog No. 16

CONTAINS 75 VACUUM TUBE HOOK-UPS, 446 ILLUSTRATIONS, 500 ARTICLES

Also Logbook of all Broadcast Stations

Just to name a few of the circuits: The V.T. as a detector and one-step amplifier; all Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; all Reflex Circuits

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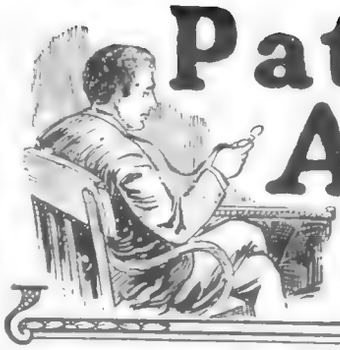

Edited By
Joseph H. Kraus

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

BED-BUG POISON

(943) Q. 1. J. D. Collins, New Orleans, La., has discovered a compound which when properly made is a very effective bed-bug exterminator. He asks our opinion upon the placing of this formula on the market and whether or not he should attempt to patent it.

A. 1. Undoubtedly, if you are financially able, you could manufacture the compound and place it on the market. This latter work would necessitate an extensive advertising campaign, and upon this, the ultimate success of the proposition will rest. If you do not desire to go into the proposition to this extent, we would suggest that you communicate with one or more of the various manufacturers of similar household supplies. It is entirely possible that you might be able to persuade them to manufacture and sell your compound. Before you disclose the details of the system, make up an evidence of conception which consists of drawing up a complete set of specifications covering the formula and having each sheet signed, sealed and dated by a notary public before two witnesses. This protects you for a period of two years. This evidence is for your own files and only to be used in case of necessity for prosecuting interferences and infringers.

MOTOR-DRIVEN SAW

(944) Q. 1. Clarence A. Curry, Lowsville, W. Va., has invented a motor-driven hand saw upon which he desires patent advice.

A. 1. We would advise you that there is nothing at all new in your proposed type of motor-driven saw as several similar devices have been proposed and patented in the past. In fact, we have a copy of a patent at hand at the present time covering the design of a saw very similar to yours, but in our opinion much simpler and one which could be manufactured to sell for a lower price. Furthermore, this existing patent covers a type of saw whose actual cutting edge is much longer than yours could possibly be unless in your case you designed the protective portion to be much larger and more bulky than you show in your drawings. Considering these facts, we would not advise you to invest any further time or money in your device.

VACUUM TUBE

(945) Q. 1. Nadd Juangbhanich, Bankok, Siam, proposes the placing of a coil of wire within a vacuum tube and situated between the grid and filament. This is to be connected to the positive filament lead at one end but the other end is not to be connected in any way whatsoever, as is shown in our drawing. He believes that such a system will increase the sensitivity of a tube but has not done any experimental work with the system and desires our advice.

A. 1. We are very much of the opinion that the coil of wire you have considered placing in a vacuum tube would be of very little assistance if any at all. Such an addition would not in our opinion cause a greater flow of electrons. In fact, we believe that the placing of such a spiral would decrease the actual number of electrons reaching the plate of the vacuum tube and hence render the tube less sensitive in operation. We would not advise you to proceed with your device in a commercial way as we do not believe that it would ever prove practical. If we can help you any further in your work, do not hesitate to address us.

STEAM DRIVEN ELECTRIC GENERATOR

(946) Q. 1. Roy Jones, Detroit, Mich., proposes to operate a steam engine from a source of supply and to cause that steam engine to drive an electric generator. The generator is then to heat an electric resistance unit which in turn heats water, generates steam and runs the original steam engine. He asks our advice.

A. 1. Your particular combination of steam and electric engine is positively impractical and will not operate. The largest generator which can be driven by a certain sized steam engine will not furnish enough current to heat sufficient water and evolve steam to operate the aforementioned steam engine. This is merely another version of an age-old idea concerning perpetual motion and will not operate.

SWIMMING GLIDER

(947) Q. 1. Robert F. Smith, Minneapolis, Minn., has designed a device to be used in amusement parks desires our opinion upon its patentability and practicability. The device is to be constructed on the order of a ski track, but is to be used at bathing beaches and is to employ a small specially constructed glider in which the swimmer rides. Upon reaching the end of the slide the glider is projected off into space, and by proper manipulation it is supposed to travel a distance of several hundred yards.

A. 1. We are very much of the opinion that there would be too much danger in the operation of your device to make it a paying proposition. In using it, the operator would have to be somewhat skilled and for that reason we do not believe that a proposition of this type would attract paying customers. Of course, the only way to determine its patentability is by an actual trial, in which event you should first protect your rights as inventor by means of an evidence of conception which consists of drawing up a complete set of designs and specifications covering the device and having each sheet signed, sealed and dated by a notary public before two witnesses. This is for your own files and only to be used in case of necessity for determining and proving priority either in interference proceedings or in infringement rights.

PROTECTION

(948) Q. 1. Louis Peeters, Hollywood, Calif., says that a certain party has offered to protect an invention of his for a short period of time and for a nominal sum, which sum is far less than that required by the Patent Office. He asks our opinion on this method of protection.

A. 1. The protection which the party you mention offers you is nothing more or less than what is known as an evidence of conception. This form can be made out by yourself and merely consists of making up a complete set of drawings and specifications and having them signed, sealed and dated by a notary public before two witnesses. This protects you for a period of two years during which time you conduct experimental work and eventually apply for a patent upon the idea. Another method of securing protection is to have complete details of your device published in some magazine. You will then be protected for two years from the date of the issue of that magazine.

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Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, methods, etc. Send model or sketch and description of your invention for INSPECTION and INSTRUCTIONS FREE. TERMS REASONABLE. BEST REFERENCES.

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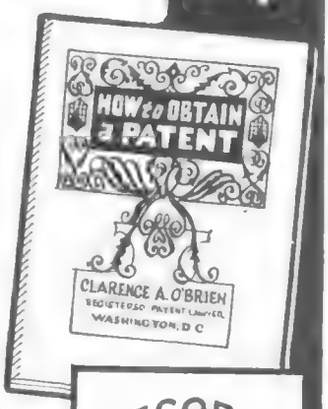
At the left is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ. All drawings and specifications are prepared under my personal supervision.



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Take the First Step Today—Action Counts

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

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☐ Telegraph Expert	☐ DESIGNER
☐ Practical Telephony	☐ BUSINESS MANAGEMENT
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☐ Surveying and Mapping	☐ Commercial Law
☐ Mining Engineer	☐ GOOD ENGLISH
☐ ARCHITECT	☐ STATIONARY ENGINEER
☐ Architectural Draftsman	☐ CIVIL SERVICE
☐ Architects' Blue Prints	☐ Railway Mail Clerk
☐ PLUMBING AND HEATING	☐ Textile Overseer or Supt.
☐ Sheet Metal Worker	☐ AGRICULTURE
☐ Navigator	☐ Poultry Raising ☐ Spanish
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This gun "free" if you can beat our price anywhere—4 or 6 in. barrel, blue or nickel—32, 38-or 22 caliber. Powerful, accurate, hard hitting. Money backguarantee. Pay on delivery $5.95. Federal Mail Order, 414 Broadway, New York, Dept. X80.
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Technical Answers to Questions

(*Continued from page 260*)

No. 9.—Crude oil is oil in its natural state and this is pumped from the ground in that form to be later refined.

No. 10.—The noun "germ" means a small mass of living substance, capable of developing into an animal or plant or into an organ, or it may mean an embryo in its early stages, a sprout, a bud or a seed, and consequently in the popular usage of the word is any micro-organism, especially the pathogenic bacteria. The words bacterium and germ are used synonymously. Bacteria (plural of bacterium) are classified into many groups, such as acid-fast bacteria, namely, those which retain analin stains and are not decolorized by five per cent mineral acids, amotile bacteria or bacteria which are incapable of motion, as the bacilli of anthrax, infectious bacteria, namely, those producing specific infection, toxic bacteria, those producing toxin or poison, etc.

No. 11.—Primarily the difference between a musical note and a noise is one of vibration. Were one to take a block of wood and drop it, it would create a noise. Were five or six blocks of wood dropped and each of these blocks respectively smaller, the noise would constitute a group of sounds which if the frequency of their vibrations were properly related could be classified as musical notes. Broadly, noise is confused and senseless sound, and what would be music to one ear might be noise to a super-sensitive individual.

No. 12.—Dark-eyed parents can have blue-eyed offspring, if in some previous generation, on the part of either mother or father or grandparents, there have been blue eyes in the family. If all four grandparents had black eyes, and all of their children had black eyes then the third generation will be born with black eyes.

Book Review

FOUNDATIONS OF THE UNIVERSE by M. Luckiesh. Stiff cloth covers 5½" x 8½", 241 pages. Published by D. Van Nostrand Co., New York City. Price $3.00.

Whatever Dr. Luckiesh writes possesses two qualities. It is scientifically accurate and always amusing. He has the art of making science a topic for readable works. The epoch of Einstein is very respectfully treated by our author, far more so than in Prof. Poor's most interesting book, which was also reviewed in our columns. Perhaps the last line of Dr. Luckiesh's quotation from Pope's "Essay on Man" would almost cover his section on Einstein. "The glory, jest and riddle of the world!"

The book goes through every branch practically of the titular subject, and as a sample of intelligent treatment of a very comprehensive subject, we would refer to Chapters 15 and 16. One is devoted to the growth of knowledge starting with Thales and coming down to our illustrious American scientist, Millikan. The other chapter on units and magnitude give a capital summary of its subject in only five pages. A very nice index follows, and while they are advertising pages, not the least valuable part of the book is a list of other books by Dr. Luckiesh. Whatever he writes is at once instructive, suggestive and agreeable reading.

MARKETING POULTRY PRODUCTS by Earl W. Benjamin, Ph. D. Stiff cloth covers 5¾" x 9¼", illustrated, 328 pages. Published by John Wiley & Sons, Inc., New York City. Price $3.00.

Housekeepers, who want to be scientific, should carefully read this book to find out how they should pay for their poultry products, how they should treat chickens for cooking purposes, all about eggs, how to kill a chicken, how to tell old birds from young, for any quantity of similar details are given here. It is, however, primarily intended for dealers. The illustrations are very numerous, some even in color. The details of apparatuses and appliances on a large and small scale down to the last detail are described and illustrated. Educational work in marketing is also given, a polite name perhaps in some cases at least for advertising. A very nice bibliography with an excellent index follows.

PERPETUAL MOTION by Percy Verance. Stiff cloth covers 5½" x 8", illustrated, 366 pages. Published by 20th Century Enlightment Specialty Co., Edwardsville, Ill.

The author of this book is attempting an impossible task we fear to dissuade strivers after perpetual motion. In the preface he says that he has written the book to enlighten the strugglers for perpetual motion to get them away from the impossible task of evolving a mechanical absurdity, and make them devote their energies to the practical side of things, but it is doubtful if he can do it. Accordingly we find in this very nicely printed book a great number of the attempts at perpetual motion described and illustrated. When anybody tries to patent a perpetual motion ma-

(*Continued on page 282*)

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Tarrano the Conqueror

By RAY CUMMINGS

(*Continued from page 229*)

In another place, at the bottom of a canyon roared a surging torrent of river. A harnessed river; plunging into turbines; emerging to tumble over a cascade, its every drop caught by turning buckets spilled again at the bottom. Water pursuing its surging course downward, its power used again and again. The canyon dry at one place near the lower edge of the city, the water all electrified, resolved into piped hydrogen and oxygen. Like a tremendous clock ticking, the water, momentarily dammed back, was released in a torrent to the electrolysis vats. The hissing gases, under tremendous pressure, raised up the heavy-weighted tops of two expanding tanks. Another tick of this giant clock—the gases released, were merged again to water. The tops of the tanks lowered, each in turn, one coming down as the other went up—hundreds of tons of weight—their slow downward pull geared to scores of whirling wheels—the power shifted to dynamos scattered throughout the city.

It was the twilight of nightfall when we arrived over Industriana. A thousand funnels and chimneys belched their flame and smoke—the flame tinting the sky with a lurid yellow-green glare, the smoke hanging like a dim blue gauze through which everything seemed unreal, infernal.

From the city rose a roar—the myriad sounds of industry mingled by the magic of distance. And as we got closer, the roar resolved into its component parts; the grinding of gears; clicking of belts and chains; whirring of dynamos and motors; shrill electrical screams; the clattering of falling ore; clanking of swiftly moving merchandise, bound in metal, magnetized to monorail cars shifting it to warehouses on the near-by hills. And over it all flashed the brilliant signal lights of the merchandise traffic directors whose stentorian electrical voices broadcasting commands sounded above the city's noises.

An inferno of activity. A seeming confusion; yet the aspect of confusion was a fallacy, for beneath it lay a precision—an orderly precision as calm and exact as the mind of the Director of a Signal Tower counting off the split seconds of his beams.

An orderly precision—the brain of one man guiding and dominating everything; at his desk alone for long hours throughout the days and nights. A quiet, grey-haired gentleman; unhurried, unharrassed, seemingly almost inactive; always seated at his empty desk smoking endless arrant-cylinders. The dominating business brain of Industriana.

CHAPTER XXXII

Departure for Battle

Georg and Maida were very busy in Industriana; and now Elza and I were admitted to their activities—Elza and I, with our new-found love and happiness neglected for the greater thing, the welfare of the nation upon which hinged the very safety of Venus itself; and Mars; and our own fair Earth.

Industriana, greatest commercial and manufacturing center of Venus, had been given over momentarily to the preparations for war. The Rhaals had at last turned from industry to the conquest of Tarrano. Preparations were almost completed; our armies were to start within a very few times of sleep.

I had had no experience in warfare; but the history of our Earth had told me much of it. The enlisting and training of huge armies of men; arming them; artillery; naval and air forces; commissary and supplies; a gigantic business organization to equip, move and maintain millions of fighting men.

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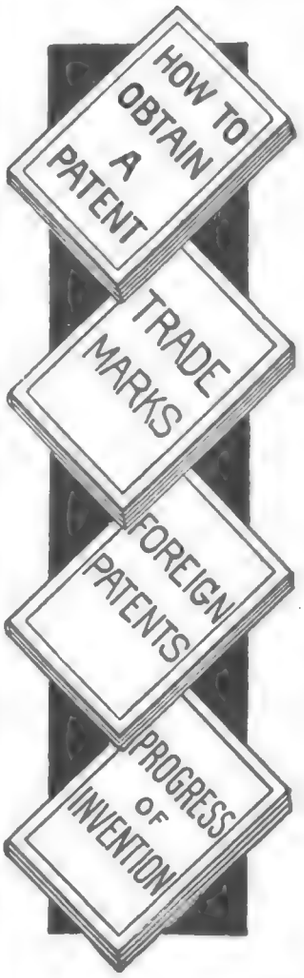

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Ancient warfare! This—our modern way—was indeed dissimilar. It was, from most aspects, simplicity itself. We had no need of men in great numbers. I found something like a single thousand of men being organized and trained. And equipped with weapons to outward aspects comparatively simple.

On all the three worlds the age of explosives of the sort history records, was long since passed. Electronic weapons—all basically the same. And I found now that it was the power for them, developed, transformed into its various characteristics and stored for individual transportation and use, which was mainly engrossing Industriana.

I had opportunity, that first night, of meeting Geno-Rhaalton—the present head of that famous Rhaalton line, for generations hereditary leaders of their race.

We found him, this Geno-Rhaalton, in a secluded, somber little office of black metallic walls, grey hangings and rug, a block of carved stone his desk, and a few of the stiff-backed stone chairs, each with its single prim cushion.

The office was beyond sight and sound of the busy city. His desk was empty, save for the array of apparatus around its edges—the clicking tabulators which recorded, sorted, analyzed and summarized for him every minute detail with which the city was engaged.

Machines of business detail. We had them, of course, in the Inter-Allied offices of Great-New York. I have seen our Divisional Director voice into a mouthpiece the demand for some statistical summary computed up to five minutes before, and covering his entire Atlantic Division. He would have it, recorded in cold print before him, within a moment.

Yet, compared to the Rhaalton efficiency, our own methods seemed antiquated indeed. This man was in touch with every transpiring detail simultaneously; yet not confused by them, for every detail was also combined into a whole—to be examined for itself if he wished. Visually as well, the entire city lay before his gaze—the walls of the office were lined with rows and tiers of small mirrors; receivers and mouthpieces connected him with everything. Sights, sounds, and even smells of the various factories were available to him—smells when his sense of smell might be necessary for the testing of some elusive gas.

Without moving his physical body his presence was in effect transported wherever throughout the city he wished to be. A man of tremendous concentration, to handle but one thing at a time; with all the power of his brain to give instant decision, and then to forget it utterly.

I found him a rather small man; smooth-shaven; grey-haired; a grave face and demeanor, with dark eyes solemn with thought, yet twinkling often when he spoke. A man of flabby muscles and gentle voice; seemingly unforceful, and with a personality likable, but hardly dominating.

Instinctively I found myself comparing him to Tarrano. Tarrano's strong, wiry body. The flash of his eye; his inscrutability, always suggesting menace; the power, the genius of his personality—the force radiating from him which no one could mistake. His intellectual power—his concentration—certainly the equal of this little leader of the Rhaals.

Tarrano the Conqueror! Tarrano—man of destiny—risen from nothing and by the sheer genius of his will throwing three worlds into chaos, at one stage combining two worlds into his self-created Empire, and menacing the third. Surely Tarrano was a greater man than this Rhaalton. I knew it; much as I hated Tarrano I was forced to admit it.

Yet as I stood there acknowledging the soft-spoken greeting of Rhaalton, I had the

swift premonition that Tarrano was going down into defeat. And that this little man, without moving from his desk or raising his voice, would be the main factor in bringing it about.

And I wondered why such a thing could be. I know why now. Tarrano, with all his genius, lacked just one quality which this little man had in abundance. The milk of human kindness—humanity—a radiating force the essence of which paradoxically was the unforceful gentleness of him. The Almighty—as we each of us in our hearts must envisage our God—is just, but gentle, humane in His justness. And with all the genius in the Universe—the warlike power—the weapons—the cohorts—all the wonderful armament of war—you cannot transgress the Will of the Almighty. Against all human logic of what should be victory—you will meet defeat . . .

The thoughts fled through my mind and vanished into the realities of the present. Rhaalton was saying:

"We will be ready within another time of sleep. Jac Hallen, you wish, I suppose, to go out with our forces?"

"Oh yes," I said.

He smiled. "The eagerness of youth for danger! And yet is very necessary—very laudable—"

He passed a hand across his forehead with a weary gesture—a gesture which seemed to me despondent. Could this be our vaunted leader? My heart sank.

Bisecting the slope was a vertical street—a broad escalator of moving steps, one half going upward, the other down. Beside it, a series of other escalators for the traffic of moving merchandise.

He added abruptly: "We shall conquer this Tarrano—but at what cost!" His smile was wistful. "We must choose the lesser evil."

Still gently, almost sorrowfully, but with a directness and clarity of thought which amazed me, he plunged into a detailed account of what Georg was to do in command of our forces. My own part in it, already planned by him in detail. Maida's part. Elza's. The division of Rhaal maidens.

Girlhood in war! It seemed very strange. Yet the Rhaal maidens were going as a matter of course, since there were some activities for which they were more fitted than men were. With all the Rhaal maidens going, Elza and Maida would not stay behind. And though Maida—a wife—was objected to by Rhaalton, he had yielded finally to her pleading.

I will not now detail our plans or our armament. We had, in general, one thousand unmarried men, in five divisions of two hundred each. They were largely Rhaals, with the few Earth-men previously sent us; fifty perhaps of the most loyal

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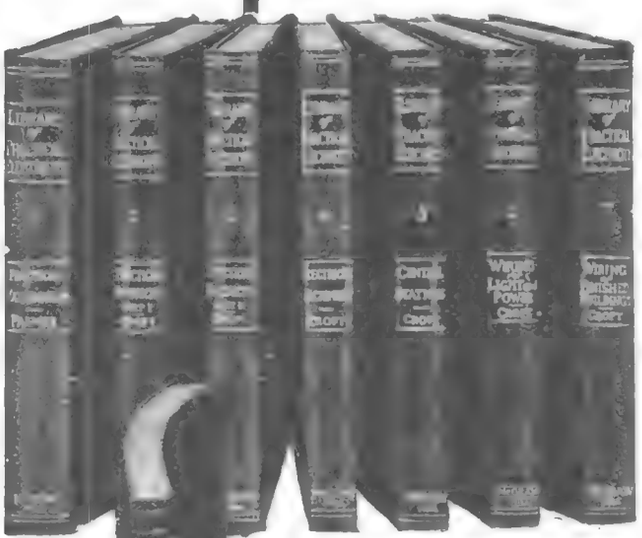

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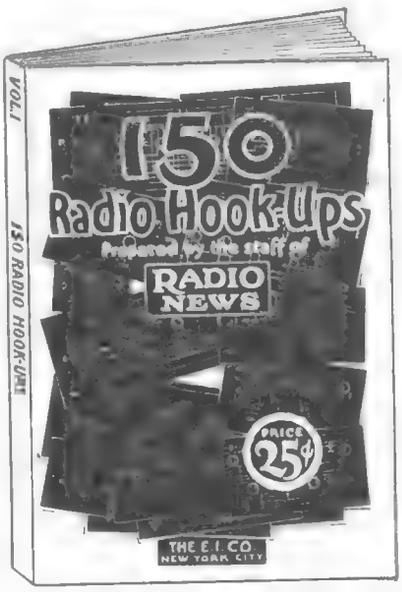

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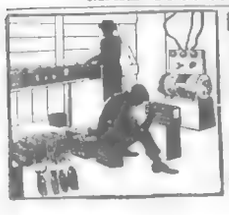

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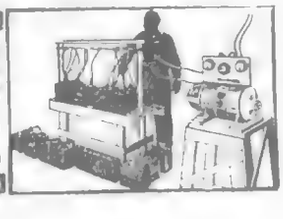

Slaans; and a scattering of the other races of the Venus Central State. A few—thirty perhaps—of the Little People of Mars. In addition, another hundred men, individually in charge of the larger apparatus and the vehicles. And the division of two hundred girls.

Our journey to the Cold Country was to be made on flying platforms and vehicles of various sizes; some large to carry fifty passengers or more; others so small that only one person could be carried. These latter, the girls were to use. I call them platforms. In this size they were not, literally speaking, much more than the transporting mechanism fastened to the girl's waist.

There were also heavier vehicles carrying the larger apparatus; and several of fairly large size with food, clothing, housing equipment—supplies of all kinds for our maintenance abroad. A dozen vehicles also carrying huge skeleton towers, encircled at the top with ray projectors. A vehicle with a single room—an instrument room fully equipped with which Geno-Rhaalton at his desk would be in contact with our every move. And largest vehicle of all—in aspect a solid, squat affair almost of a size for inter-planetary travel—our power plant.

It was all of that; but oh! it was more than that as well. My Elza, raising her tear-stained face and kissing me. Murmuring, "Jac, I love you!" Murmuring her love: "Jac dear, you're safe! I've wanted so long to be with you again —I've been so frightened—so frightened—"

We started at dawn of the second morning after my own arrival in Industriana. The girls were to travel to the borders of the Cold Country on the larger vehicles, but they wished to start flying individually for the first few helans of the journey for practice. Georg, Maida, Elza and I were to travel in the instrument room.

We massed upon a broad hilltop near the city. In the grey twilight of dawn with a flush of pink in the sky where the sun in a few moments would rise, I stood in the outer doorway of the instrument vehicle. Around me was the confusion of departure. Eager young men; laughing girls, flushed with excitement. The gayety of youth going to war! Young as I was myself, I was struck with the drama, the pathos of it. What would the home-coming be?

Georg, Maida and Elza were with me. Geno-Rhaalton stepped up to us. Bareheaded. A solemn little man, heavy-hearted.

"Goodby," he said simply. "I know you will do your best."

"Jac! Look there!"

I followed Elza's startled gesture to the soft, white clouds which were massed in the sky above us. By what magic of science the thing was accomplished, I know not; but up there in the clouds a gigantic image of Tarrano was materializing! His head and

shoulders. Arms folded; his face with a sardonic smile leering down at us! Lips moving. And out of the air about us came his audible, broadcasting words.

"Do your best, my friends!" Ironic mockery! *"Coming to conquer Tarrano? Hasten! You are keeping Tarrano waiting most impatiently!"*

The giant voice died away into silence; the huge image melted into the clouds and vanished.

Rhaalton looked at us again, expressionless. "Goodbye," he repeated. "Do your best."

He turned away abruptly. And then as he walked with a despondent droop, I saw his shoulders suddenly straighten. He flung a hand into the air. The signal to start! From a tower in Industriana a puff of violet light shot up to magnify the signal.

The girls, all in their places, rose into the air. Draperies fluttering, like graceful birds they rose, circled over us in an arc; and then in a long, single line, with officers apart to one side marking them in squads of twenty, they sped into the dimness of distance.

The tower vehicles now were rising. Then the larger platform; the power plant, like a floating building sailing majestically up.

"Come, Jac."

Elza and Maida were inside the instrument room gazing through one of its windows; and Georg drew me within, closing the transparent door after us. Through the windows I could see the line of vehicles following after the girls. Then our instrument room rose quietly, soundlessly. The ground dropped slowly away, then faster; and as we swung about I saw the hilltop beneath us. Its sides were lined with waving spectators; stricken momentarily with awe at the apparition of Tarrano, they had already forgotten it; from every vantage point of Industriana they were frantically waving.

But the hilltop was empty, save for one lone figure—Geno-Rhaalton standing sorrowfully gazing after us.

(*To be concluded*)

$11,000 for Spirits

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of $11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent? Should we not consider every psychical manifestation as being trickery pure and simple, intended primarily to fleece those who visit the circle and who find solace in the words from the worst forms of charlatans, namely those who are being permitted to practise upon the poor, seeking words from loved ones?

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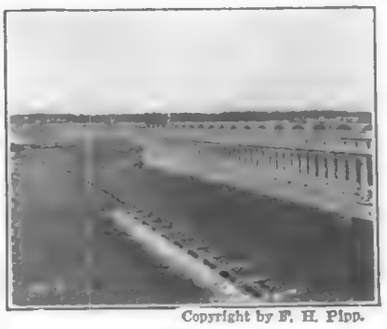

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The world's industry is turning to electricity for its power. Homes are using labor saving electrical devices and electricity for lighting, cooking, etc. Big production depends on electrical power. Here is a picture showing Wilson Dam, with its power house 1,200 feet long and capable of generating 625,000 H. P. There's big money waiting for you when you have been trained to be an electrical expert. Great jobs like this constantly demand well trained men—big pay men. Now you, too, can be trained quickly, right on the job, doing the actual work. No books.

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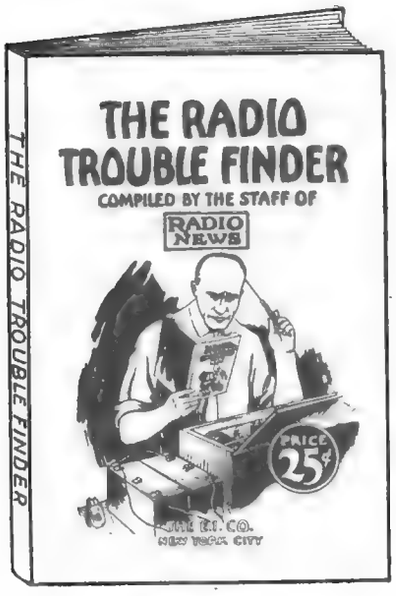

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How to Build Your Own Airplane

(*Continued from page 242*)

WEIGHT

Weight empty, 370 lbs.
Weight loaded, full load, 600 lbs.
Wing loading, 5½ lb. per sq. ft.
Power loading, 17 lbs. per H. P.

POWER PLANT

Anzani 3 cyl. 30-35 H. P. (preferred)
Propeller, 6 ft. dia., 5½ ft. pitch.
Propeller speed 1,500 rpm.
Oil capacity 5 qts.
Gas capacity 6 gal.

PERFORMANCE WITH FULL LOAD

Maximum speed, 90 m. p. h.
Cruising speed, 75 m. p. h.
Minimum speed, 35 m. p. h.
Range, 250 miles.
Miles per gallon of fuel, 35.
Climb, 800 ft. per minute.
Factor of safety throughout 11.

CONTROL FEATURES

By looking at the drawings, if you are somewhat familiar with airplane controls, you will see that the standard control as used in all the Army planes, is here utilized. The so-called "joy stick," as will be seen from the drawings, is pushed forward or backward in order to raise or lower the horizontal rudders which cause the tail to rise or fall, as the case may be. By moving the joy stick sidewise, the out-board ailerons are moved up and down for turning and banking. The vertical rudder of use in turning and banking is moved sidewise as required, by means of the two vertical rudder wires running back through the fuselage from the foot control lever, which can be seen in dotted lines in the top view of the airplane.

The fuselage or body of this sport plane is made up of strips of wood, such as spruce, and after being built to the proper shape, is covered with airplane linen, which can then be given several coats of nitrate dope and then Valspar. A great many of the accidents which have occurred in flying airplanes has been due to the wing breaking off, especially when making a turn due to the great stress put on the wing which crumpled up, or simply broke off at this critical juncture.

Therefore, it is important to remember before attempting to fly any airplane, whether factory or home built, to stand on the wings and pull on them so as to see that they are good and strong. The "flying course" cited above, as well as many of the leading books on flying, tell how to check up all of the angles of the wings accurately and also how to put a test on them, so as to know just how strong they are. As pointed out in the U. S. Army Flying Manual, it is very important to carefully check up the various angles of the wings and the angle of one wing with respect to the other, for on these factors depend the stability of the airplane when in flight.

In selecting wood for airplane construction only straight grain wood, such as spruce which is very tough, should be tolerated, and furthermore, it should be free from knots. Unlike building a piece of furniture or a model out of wood with glue and a few bolts, it is not sufficient in building an airplane to carry you through the air safely, that the finished job simply looks strong; it must be strong, and as aforementioned, it is the best idea to get the opinion of an experienced flyer before you venture aloft in any airplane, whether home or factory built.

Dependent upon what type of engine you elect to fit on your sport plane, the matter of the engine mounting frame at the front of the plane will vary. The steel plate mounting shown in the drawings here is for

the Anzani three-cylinder 30-35 H. P. motor. This engine mounting plate is made from No. 12 gauge sheet steel, and the very important point to be watched here is that this engine mounting plate is rigidly secured to the fuselage. This feature is taken care of by means of turn buckles and the ⅛ inch stranded steel cables, as drawings clearly show.

It is practically impossible for an amateur to make a satisfactory propeller, and so this is to be purchased. It can be obtained from various airplane companies or from the designers and builders of this sport plane. The wheels of the landing gear are fitted with pneumatic tires, and the landing gear is made doubly resilient by means of ½ inch diameter rubber band, several turns of which are placed around the axle and the landing gear V frames, as the drawings indicate. The tail skid, as will be seen, is adjustable, and has a resilient feature, thanks to several turns of ½ inch diameter round rubber band.

If the prospective builder of this sport plane is a swimmer, it will probably be a very good idea to first try out the plane as a seaplane, fitting pontoons to the bottom of the landing gear vee's, instead of the wheels. With the pontoons, the weight of the plane will be greater and no smaller engine than the Anzani 30-35 H. P. three cylinder type should be tried. A little experimenting will have to be done in order to find the best position of the pontoons under the plane.

FLYING LAWS

If you are in doubt as to the flying laws in your locality, you can find out all about them by applying to the chief of police of your city or town, or else to the proper authorities at the county seat or state capital. We give herewith some data kindly supplied by *Aviation*, in regard to the present flying laws in those states which have recognized statutes covering aerial flight.

There are no federal laws or regulations governing aircraft or the licensing of pilots. The Bingham Bill, now under consideration by Congress would cover this matter. Several of the states have passed laws seeking to control the operation of aircraft and the licensing of pilots. There are in addition, a number of city ordinances, limiting the operation of aircraft over congested areas and specifying an altitude at which planes may fly, and directed against landing in public parks, stunting, etc. The states below have regulations such as referred to above:

Connecticut, requires pilot's license and charges $2.00 for same. Florida, requires pilot's license and charges $25.00 for same. For certificate of airworthiness of aircraft (optional) $100.00, for privilege of commercial aviation, $100.00, inspection of airdrome $50.00. Massachusetts requires licenses and charges $5.00 for same. Tennessee requires licenses and charges $25.00 for commercial operation of aircraft. Minnesota requires licenses, issued by adjutant general on passing test. Fee, $10.00, renewals, $2.00.

(Editor's note:—The name and address of company supplying this speedy little sport plane, as well as various types of engines, propellers and all parts, such as brazed fittings, etc., will be supplied upon receipt of stamped and addressed envelope. As mentioned in the article, the flyng course costs $5.00, *and the complete set of blueprints giving more details than can be published in the space we have available for the subject, cost* $15.00. *We have not shown in the drawings herewith some of the small details of parts, such as clamps and brackets which join fuselage struts and longerons together at right angles, as it is seldom that the amateur aircraft constructor can make these parts properly, for they have to be very strong as well as light in weight. The majority of them have to be welded or brazed, after being cut out of sheet steel, and it is, therefore, best to buy them ready to put in place.)*

(Next installment in August Number.)

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Bottle Feeding the Orchid

By DR. ERNEST BADE

(*Continued from page 207*)

colors of their own. But this is not invariably the case, as the pigments of the hybrids may develop characteristics which were entirely unforeseen.

The photograph herewith shows young orchid with first flower; the plant here illustrated is five and one-half years old.

ARTIFICIAL FERTILIZATION

In propagating orchids another factor must be considered. The fertilization of the flower must be carried out artificially in the greenhouse by bringing the pollen of one species upon the pistil of another. Approximately a year must elapse before the seeds are ripe. These are exceedingly tiny and the embryo itself consists of very few cells. If the seed is now placed in a favorable location for germination, it will absorb moisture and develop a top-shaped structure approximately 1-64-inch in diameter. At this stage of its growth, the seedling seems to remain stationary for months, no definite change being visible. But then, too, it may happen that the seedling grows quite rapidly without any apparent hesitation. This occurs when a certain definite fungus enters the seedling. In some cases a number of such fungi influence the growth of the seedling favorably. In the majority of cases the seedling dies if the fungus, necessary for its further development, does not enter it, or if a different one makes its home in this tiny plant.

The growing of orchids is not so difficult as has been hinted by some flower growers. Here is one of Dr. Bade's orchids, two and one-half years old, growing lustily in a two and one-half inch pot.

On penetrating the seedling, the fungus causes certain chemical reactions to take place, their character depending upon a peculiar catalytic nature; such reactions may be either favorable or unfavorable for further growth. Certain well defined cells are entered by the fungus, and when these

have been practically filled, the nucleus of the stricken cells take on an amoeba-like shape. They send out pseudopods, slimy bodies, about the threads of the fungus, suck them out, and finally surround them with a membrane. Now the nucleus changes to its normal shape and waits for a renewed growth of a fungus which is then attacked again. After each penetration of the fungus, the seedling grows quite rapidly, but in spite of this, the young plant requires years before it is sufficiently mature to produce flowers.

By reason of the number and minuteness of the orchid seeds, no reserve food supply like that provided by other plants, can be given them. The young seedling must seek its own food and this it finds in the fungus for which it provides a place of growth, and when this parasite has made itself at home and begins to threaten the nucleus, the latter turns about and sucks it dry and the food so secured is used by the orchid seedling in the development of its own structure.

Even mature orchids, to a great extent, live in symbiosis with lower fungi. Since the roots do not form root-hairs for the absorbtion of water, the fungi take up this work for them, as they live in the epidermis of the roots and send, from this position, delicate hypha to the outside and it is these which accomplish the work of the root hairs.

These conditions have been known to the orchid fanciers for a considerable time and

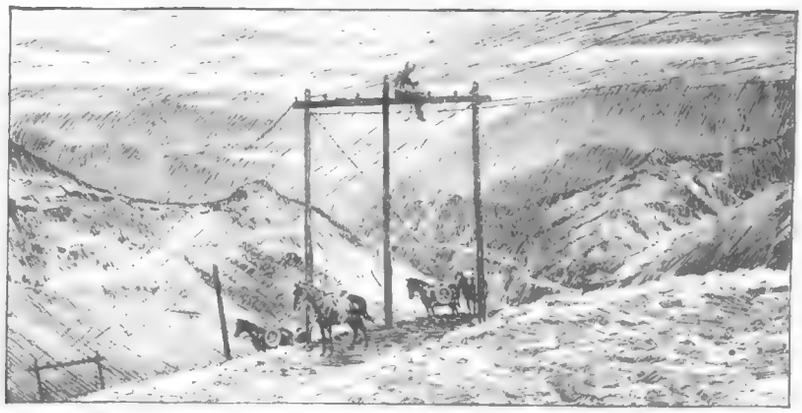
Here is a husky young orchid, three and one-half years old growing in a three-inch pot.

since the required fungus is not always available on sowing, the result of seed propagation is far from satisfactory, as the percentage of germination is not only quite low, but often germination from seed is a distinct failure. It seems quite natural that the seedling could be provided with artificial plant food both to induce and to hasten its growth. This was first accomplished by Lewis Knudson by a bacteriological method. Under antiseptic conditions he prepared a nutritive solution consisting of the following substances:

1.00 gr.—Calcium nitrate.
0.25 gr.—Dibasic potassium phosphate.
0.25 gr.—Magnesium sulphate.
0.05 gr.—Ferric chloride.
0.50 gr.—Ammonium sulphate.
15.00 gr.—Agar-agar.
20.00 gr.—Cane sugar.
1 Liter—Distilled water.

The chemicals are dissolved in the water, gentle heat is applied so that the agar may dissolve, and the mixture is carefully poured into tubes or other glass vessels, as desired, and the containers with their contents are brought into a sterilization chamber where all possible contaminating organic growths are killed. The vessels are then stoppered with a wad of cotton. The tubes are placed in an inclined position so that when the agar

Telephone line over the Rocky Mountains



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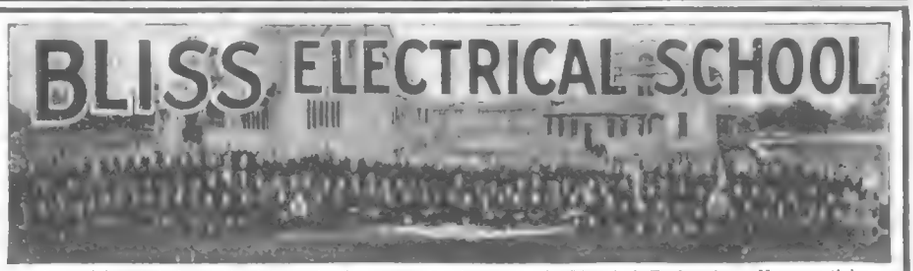

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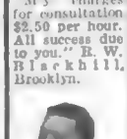

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stiffens, a larger surface is exposed to the air. When the agar is firm the orchid seeds are introduced into the gelatinous nutritive solution with a sterilized platinum wire directly from the seed-pods and the vessels are again stoppered with cotton. Germination takes place within the tubes and when the seedlings have developed sufficiently they can be transplanted into tiny pots containing the required soil mixture for their continued growth. The seedlings may also be placed in larger flasks containing the same nutritive solution and be kept in them until about five leaves and roots approximately three cm. (1¼ in.) in length, have been developed. Then the young plants must be transplanted and cultivated in pots.

As long as the seedlings remain in the tubes or flasks, they require no special care as the solution provides all things essential for their welfare. The seedlings become large and hardy and are much further developed than those raised by the older method.

Species of Cattleya are generally cultivated in medium sized pots for they seldom need to be transplanted. The pots must be provided with very good drainage and are therefore partially filled with broken pot-shreds, the rest of the pot being filled to the brim with a mixture of fragmented Sphagnum and a light sandy soil. Here it must be observed that the base of the leaves with their tuberous thickening must project from the soil. When it becomes necessary to transplant, the process should be carried out during the months of July or August as the young shoots form roots at this time. During the period of rest which lasts from December to February, the plant should receive less moisture and they should be kept in a slightly cooler atmosphere. During the period of most rapid growth, Cattleya does not require excessive heat, but it does demand a sufficient supply of water.

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$25.00 Prize for Human Aura Photo

By FENN GERMER

(*Continued from page 203*)

"through" this after-image at the Aura. He also suggests the use of color-filters like those used in color-photography, and this can be tried by the amateur with some chance of success. The colors are difficult to see, however; and the pure alcohol needed to make the screens, if it could be obtained, would probably not be used for scientific purposes.

COLORED GELATINE SCREENS

Other screens of more or less aid in getting accustomed to seeing the Aura can be made with the colored gelatines used in stage-lighting, which cost 20, 30, or 40 cents for a sheet about 18 inches square. Smaller pieces could probably be bought from an obliging stage-doorman. The most useful colors in order of their value are light and dark violet, light and dark magenta (or purple), light and dark blue. If an old stereoscope like those used for looking at picture cards can be obtained, the gelatines can be fastened or fitted to it in place of the glass lenses, thus making a very handy device for keeping other light out of the eyes when observing through the screens. It is used in two ways; the first is observing the Aura directly through the screen; the second is looking through one of the dense screens at daylight, for two or three minutes, then taking the screen away and looking at the Aura of a person who stands about two or three feet in front of a suitable background.

The illusions that one is liable to encounter in this experimenting are soon recognized after a few trials. If you look at a colored electric light for two or three minutes, then look away suddenly, you will see an "after-image" in a color complementary to the color of the light. For instance if the light is orange the after-image will be blue, if violet, it will be yellow, etc. This phenomenon is often mistaken for the Aura, especially as it occurs in a slight degree with practically every movement of the eye, although the complementary color may not always be present. One can soon become accustomed to it, however, by moving one's head and body from side to side with a slow motion when observing the Aura; then whatever you have seen that stands still and seems to remain attached to the body will be the Aura, and whatever moves and changes as you move from side to side will be after-images. After a little practice the after-images no longer bother or interfere. Another test is that the Aura should be seen about evenly on all sides of the body at

Contents for July Issue of Radio News

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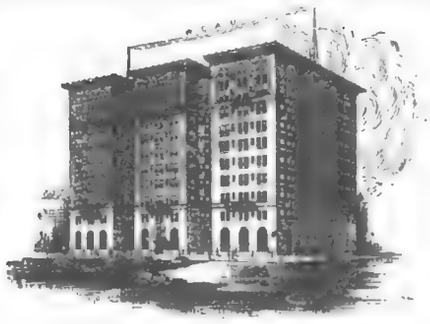

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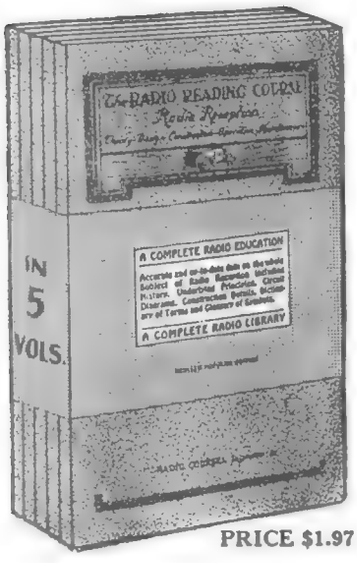

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once, whereas after-images are usually irregular or seen only on one side at a time. The two tests must be used together.

Another illusion is one caused by eyes tired from reading or from strong light; then a sort of irridescent extension appears for an inch or less above the object that one is looking at, but this is usually quite bright and appears only on one side of the object so that it is easily recognizable. If one rests one's eyes by closing them for five minutes or so after a strain, this effect will generally not occur. Another tricky illusion is produced by the faint shadows which occur behind an object when light is coming from two or more directions, but once this is seen and recognized, it will cause no further trouble.

Above all do not try to see the Aura by straining to see it. Just gaze casually and quietly at the air around a person's head and shoulders or hands (where the Aura is strongest and most easily seen), and keep your eyes as steady as possible to avoid after-images. It will be a little hard at first to focus on "air," but after several trials you will be rewarded by seeing the Aura stand out—a very interesting sight and quite startling to one who has never seen it before.

It is possible to use colored light to see the Aura; a deep blue light shows it up quite well in the dark against a black or white background. But while there is field for experimentation here, it is liable to lead the amateur astray because of the various color illusions that occur which must be carefully analyzed before one can be sure he is seeing the Aura.

To Readers of

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ULTRA-VIOLET LIGHT BEST FOR VIEWING AURA

Ultra-violet light is by far the best to use, and shows up the Aura very clearly. Mr. Clifford S. Best of Leeds, England, who has done a great deal of careful experimenting in seeing the Aura, found that the streamers or "flames" which issue from each of the fingers, as well as the rest of the Aura, became so clear in *ultra-violet light* that several hundred people who came to his laboratory were able to see the phenomenon plainly, and the English newspapers reported his experiments at considerable length. He used a mercury vapor arc lamp, fully enclosed and having a glass filter that passed only ultra-violet light—which is of course invisible to most people. Ultra-violet filters which pass no visible light have been used for fluorescent effects on the stage, and can be obtained from the Corning Glass Works, 501 Fifth Avenue, New York City. Their Blue Purple Ultra G-585-M, Red Purple Ultra G-586-A, and Violet Ultra G-586-AW, are all useful for this work. The first two transmit a slight amount of visible light, the last one almost none; but the last one is quite thick and thick glass tends to cut off ultra-violet light. These glass filters may be used in connection with any of the standard sources of ultra-violet light, like the quartz mercury arc, the iron arc, the ordinary stage carbon arc; but ultra-violet light is capable of producing severe sunburn and its use is not recommended to an inexperienced person.

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REMARKABLE AURAS

After becoming accustomed to seeing the Aura, you will have many interesting and sometimes amusing experiences awaiting you. The author worked during the summer of 1925 at the Institute Metapsychique International, a large laboratory in Paris devoted to psychic research, whose members include Sir Oliver Lodge, Professor Charles Richet, and senators, doctors, lawyers, etc. The work was in experimental thought-transference; but as a pastime he and a friend, M. Pierre Lafleche, studied the Aura.

M. Lafleche once saw a man's Aura that was split above his head, and on mentioning it to him learned that he had had his head cracked open when young. And one afternoon we were standing on a balcony watching the people pass below, when almost simultaneously we called each other's attention to the Aura of a very stout man who was passing on the other side of the street. It was just after the French luncheon hours, and his Aura, while extending as usual about 8 or 9 inches around the rest of his body, curved out to three feet in front of his stomach! We were both much amused.

We found that women, especially the *motherly* type, had as a rule much larger and brighter Auras than men, although those of men seemed to be more concentrated. On one man, a chemical engineer whose work required deep concentration, we saw two *horns* of light extending upwards from his temples. The author has also been amused watching his landlady when she gets angry: her Aura around the shoulders becomes very snaky and seems to writhe! The Auras of negroes are very definite and dense, and of a dark brown color; but while they are easy to see, they do not extend very far.

Many other curious effects and experiments can be seen and devised once the first difficulties are gotten over. A rubber band wound tightly about the finger for two or three minutes creates a dent or depression in the Etheric Body that can easily be seen.

POSSIBLE EXPLANATION OF AURA

A good working hypothesis or explanation of the Aura is that it is due to fine particles of matter emanating from the body which reflect and transmit ultra-violet light. The action of the black velvet would hypothetically be that it absorbed all the light except that which was reflected by the Aura, thus rendering that visible; while the action of the white tile, the calcimine, etc., would be that these materials absorbed the disturbing red rays and reflected some of the others and of the ultra-violet, so that the Aura would become visible by its density. People whose eyes do not focus properly can often see the Aura clearly because they sometimes bring the ultra-violet rays to a focus on their retinas, whereas normal eyes focus the longer rays on the retinas.

AURA NEVER PHOTOGRAPHED

The Aura has never been successfully photographed, chiefly because no one interested has yet had the time, money, equipment, etc., necessary for careful and scientific experiment. The right color-filters, photographic plates, and light conditions must be carefully determined with the help of a spectroscope. But there are rumors that the facilities of a large university are soon to be offered for such experimentation; however, those concerned do not wish their names revealed until the experiments are finished because of the controversial nature of the subject at present.

There remains much investigation to be done by the amateur, who sometimes gets ahead of the scientist.

[*The Editors will await with interest reports from readers as to their success in seeing the human aura, and particularly in photographing it. Sources of ultra-violet light are iron spark gaps iron arcs, and the quartz tube mercury vapor lamp.*]

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PART II.

(*Continued from page 211*)

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whipped. In one of Racine's plays, *Les Plaideurs,* in the last scene of the 3rd act, one of the characters proposes to a lady to go and watch the tortures in the prison, says it is a very nice way to pass a few hours. Thackeray in one of his essays describes his witnessing the hanging of a man. Richard H. Dana in his classic book, "Two Years Before the Mast" in 1848 or '9, describes the beating of two sailors by a Yankee Captain for no reason whatever, except to gratify his own spite and ill-temper.

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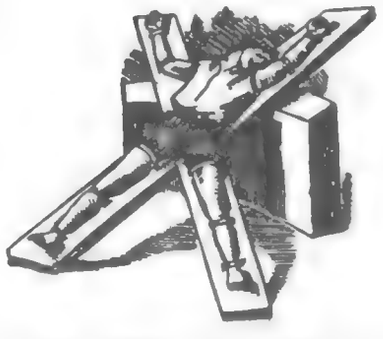
The wheels are rotated against the victim tied to the post between them and the projecting spikes slowly lacerate him.

discipline. Going back to the early centuries and down to the middle of the last century or later, we can discern a general acquiescence in the idea that torture and corporal punishment were desirable implements in the organization of society.

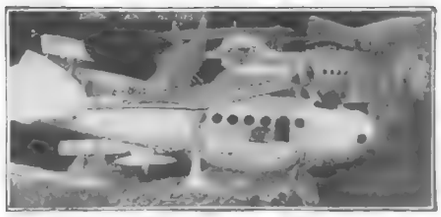
Coming through the ages, we find many books, often with awful illustrations, some of which we have reproduced, which might be taken as expressing disapproval of the horrid practice. But there is no real rebellion against it that we can find traces of. It seems to have been acquiesced in by all. And today we find the courts virtually acquiescing in it, for the judges know perfectly well about the application of the "third degree" for suspected criminals, and America has a terrible list to her discredit of floggings and burnings alive, tarring and feathering, and the like under the administration of mob law, politely termed "lynch law."

The numbers of the victims must have been very great, but there is not the least doubt that the statements of the numbers that were executed and put to death has been enormously exaggerated by some authors. The combination of religion and politics is a very bad one. The two were in very close connection in the early centuries of this era. In many cases, tortures which were administered really by the government, by the secular arm, were attributed to the Church, and where everybody regarded torture as a perfectly proper thing, it is not surprising to find churchmen in accord therewith.

(To be concluded)



The victim stretched on the St. Andrew's cross may have his bones broken by the executioner's iron or the limbs may be dislocated by pulling the beams of the cross apart.



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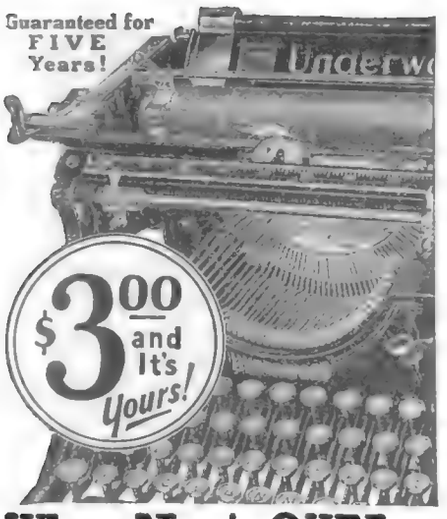

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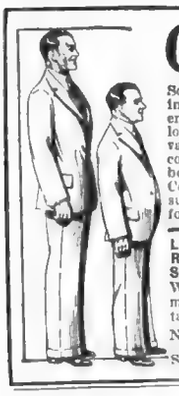

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Great Composers in WRNY Programs

By CHARLES D. ISAACSON

(*Continued from page 249*)

now broadcasting. It is under the direction of Joseph Bonime, who is best known perhaps to the American public for his work as accompanist to Mischa Elman. The solo violinist is David Robinson, and in my opinion there is none better playing in any symphony orchestra. The Edison Ensemble ranges from ten to twelve instruments, and renders programs of popular classics every Tuesday night from 8.30 to 9.30.

Arthur Williams, vice-president in charge of Commercial Relations of the New York Edison Company, is a constant visitor. He speaks fortnightly in a fascinating vein; in the alternating weeks prominent soloists are featured. Among others, Henri Scott, former leading baritone of the Metropolitan Opera Company, has appeared, and H. T. Burleigh, the famous composer of "Deep River" and many other of the new popular Negro "Spiritual" melodies.

UNUSUAL EVENTS AT WRNY

The biggest recent novelty at WRNY was the broadcast of a simultaneous musicale by Rock Ferris, organist, who was playing at the West Side Unitarian Church, and Herbert Soman's Orchestra at The Roosevelt, where WRNY has its headquarters, in the manner described on a previous page.

Another novelty was the broadcasting of a Bar Mitzvah, which is the orthodox Jewish confirmation of a thirteen-year-old boy. Rabbi Hoffman, who conducted the first orthodox Jewish wedding over the air, officiated and Nathan Ratner was the youthful confirmee.

WRNY has been highly commended for its simultaneous broadcasting of the dinners of the United Jewish Relief Society. Here is the picture: on the nineteenth floor of the Biltmore Hotel a great gathering of men had come to hear Louis Marshall and Felix Warburg speak, while on the first floor a great gathering of women had come to hear Fannie Hurst among others. WRNY undertook to broadcast both dinners, and so scheduled the speakers at both of these dinners that all the important speeches were alternated on the microphone, without the slightest hitch.

Perhaps some of you heard the "Phantom Ship" which sailed out of port at WRNY, manned by "The Buccaneers," under the direction of J. Kenneth Jones. The captain's daughter was none other than Joan Lowell, prominent actress, who, herself, belongs to the sea. The ship went through storm and calm, and encountered a pirate. All the sounds developed in the studio gave the illusion of a ship tossing through wind and sea.

Perhaps you also listened in when WRNY gave Captain George Fried a memorial of his visits to WRNY, and in tribute to the part radio played in the rescue of the crew of the "Antinoe" by the "President Roosevelt." Captain Fried received the gift with modesty and gratitude. A copy of the memorial was given also to each member of his heroic crew, as well as to all the radio editors in this city and in London.

Everyone interested in the Little Theatre movement has complimented WRNY on its ingeniousness in getting together all the participants in the Little Theatre Tournament. It was the first time they had ever come together and all their plans were discussed. Representatives were present from many states of the Union and from England.

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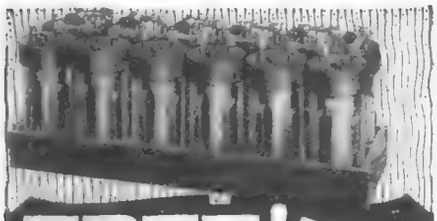

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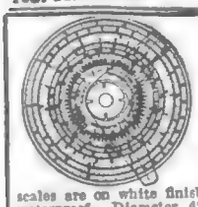

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ducted the tragic and immortal oratorio, "The Seven Last Words of Christ." Because of the manner in which it was given, this event will go down as one of the finest things ever broadcast.

Easter Sunday, WRNY began with chimes at Grace Church and had many special services.

HOW NEWSPAPERS ARE PRINTED

Early one Sunday morning WRNY carried its microphones into the great building of the *"New York Times,"* broadcast the sounds of the press rooms, and carried its listeners on a tour through the different offices, news, editorial and business.

Speaking of newspapers, WRNY has effected permanent relations with the *"New York Sun,"* which is now responsible for the sports and the commercial digest news every night. If you want the best reports on sports, just tune in WRNY, and hear Joe Vilas's report direct from the *Sun*. This comes every night at 7 o'clock.

The Theatre Press Agents had the time of their life at their revel given at WRNY on the eve of their great big benefit performance. They produced an original sketch showing the trials of the press agents, in which there appeared the leading men and women of the fraternity.

It would be unseemly to allow this month to pass by without mentioning some of the prominent people who have been here, such as Col. Roosevelt, Bishop Manning, Sophie Irene Loeb, Clara Clemens, the daughter of Mark Twain; the cast of the "Alias the Deacon" company, which brought Burton Churchill, Virginia Howell, and John B. Hymer; also Ernest Truex, Bide Dudley, Phil Baker, J. C. Nugent, Ruth Nugent, Mona Morgan, Grant Mitchell, Marguerite Namara of "Pinafore," and many others.

Another thing that should be recorded is that every Saturday night the Drawing Room Players are heard in original plays based on "Face to Face With Great Musicians." For each performance one composer is selected, and a dramatic scene from his life enacted. First came Bizet with his drab existence of "one must live," then the laughing Rossini; then the temperamental and selfish Wagner.

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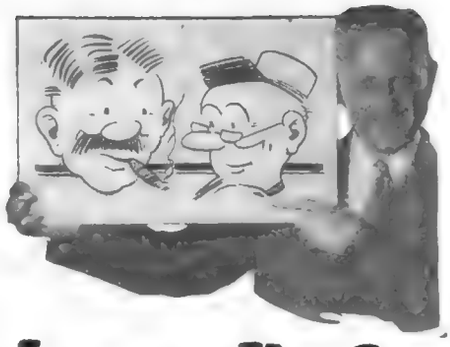

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chine, he finds that the patent office will not consider it under that title, he has to call it a mechanical movement or something of that sort, so as to dodge the issue. It is not going too far to say that on going through this book with its numerous illustrations, many of them reproductions from ancient works, they certainly do give many ideas of mechanical movements. We even find the magnet used in an attempt at perpetual motion nearly one hundred years ago, and of course we have all the siphons that anyone can want. The book is really very interesting, and we recommend it to only too many of our readers who are trying to do what never will be done.

REWINDING SMALL MOTORS by Daniel H. Braymer and A. C. Roe. Stiff cloth covers 5¾" x 9¼", profusely illustrated, 247 pages. Published by McGraw-Hill Book Co., New York City. Price $2.50.

When we say that this book is very practical, that its mathematics are kept at the lowest possible amount, and that the working details are given with the greatest fullness and with numerous illustrations, we feel that we have told our readers what they want to know about it. The practical feature of it with the eminently useful illustrations is perhaps the most interesting thing about it. Especially is rewinding given quite in detail. If anyone thinks that stator winding is a simple thing, we would refer them to the picture on page 139 showing a stator winding ready for assembly. Consequent-pole motors, repulsion type motors and the other kinds are considered in good detail, and as the reviewer goes through it in a hasty way, which lack of time enforces upon him, he is impressed by what we may term the adequacy of the book, and its index is so full that it carries out the conception which he has formed.

TINKERING WITH TOOLS by Henry H. Saylor. Stiff cloth covers 4¾" x 7¾", Illustrated, 248 pages. Published by Little, Brown & Co., Boston, Mass. Price $2.00.

The writer of this review has done considerable tinkering with tools, but in a certain sense he feels that he has done a great deal of tinkering with inadequate ones. This book telling the right way to do things, so often done in the wrong way, and covering the requirements of the house rather than the shop, certainly makes excellent reading, and is to be highly recommended to the increasing class of men and perhaps women who do much work about the house. Wood joinery is especially nicely presented with illustrations. Even the amateurs' unsolved problem of doweling is treated, and are told how to get the holes for the dowel pin exactly opposite one another. He does not give the old trick of putting a pin between the surfaces to be doweled together, with the head at the center of the dowel holes. Then by putting the boards together the corresponding indentations are made which give the center of the holes for the dowel pin. A great part of the book is devoted to carpenter work, electrical work, and all sorts of things, masonary, painting, plumbing included, are to be found in its pages.

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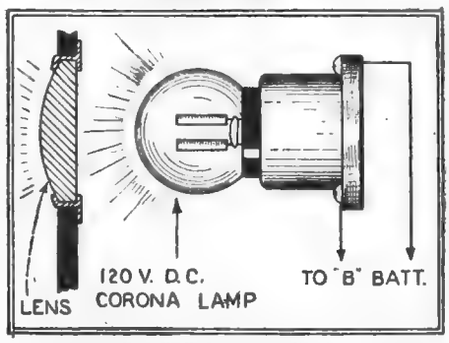
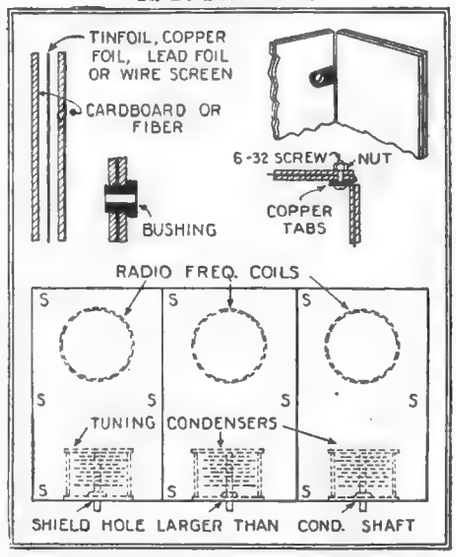
Radio Wrinkles

TELL-TALE AND PILOT



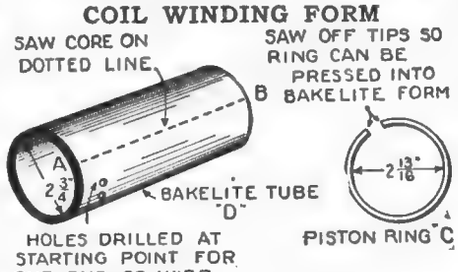
A combination "B" battery tell-tale and pilot light may be made from one of the new Corona type lamps, the latest product of the Edison Lamp Works of the G. E. Co. The lamp is connected to the 135-volt "B" battery through a switch. When the set is on, the lamp glows. If the voltage of the battery falls much below 120 volts, the lamp ceases to function. Despite the fact that this lamp derives the energy necessary for its operation directly from the "B" battery, the drain is slight, since it draws less than 6 milliamperes.
—H. W. S.

R. F. SHIELDS



The advantages of individually shielding the tuning units in a tuned radio frequency set will be readily appreciated by those who have experienced interference due to pick-up by the coils. The above diagram shows an easily-constructed shield which may be applied to a set which has already been completed, or to one about to be constructed. —H. W. S.

COIL WINDING FORM


SAW CORE ON DOTTED LINE
SAW OFF TIPS SO RING CAN BE PRESSED INTO BAKELITE FORM
BAKELITE TUBE "D"
HOLES DRILLED AT STARTING POINT FOR ONE END OF WIRE
PISTON RING "C"

It is often difficult to remove a coil of the self-supporting type which has been wound upon a glass bottle. If the stunt shown in the above diagram is employed, the coil can be removed without the slightest difficulty. The piston ring, C, is pressed together and inserted in the bakelite tube, springing it apart along the sawcut. After being wound, the coil slips off the tube easily upon removal of the ring. —William H. Teppo, Rep. No. 17343.

(*Continued on page 285*)

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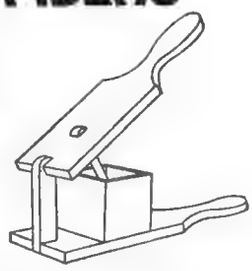

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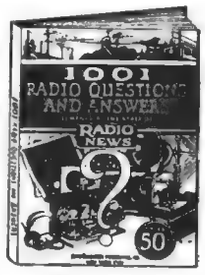

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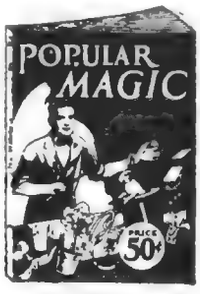

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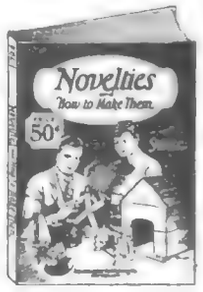

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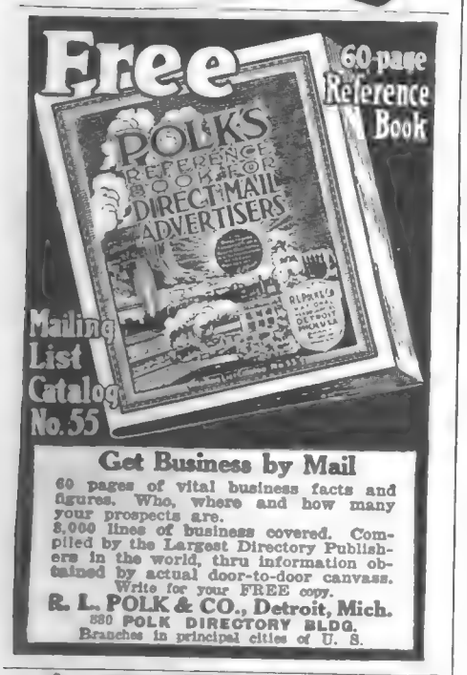
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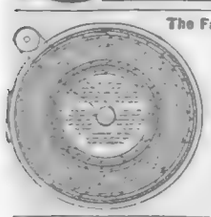
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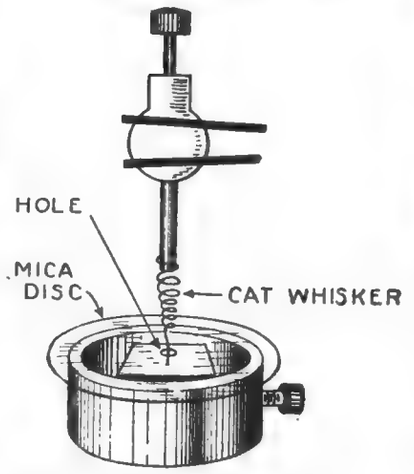
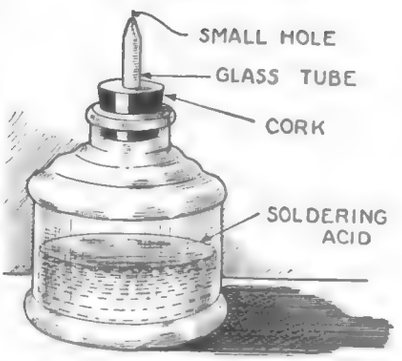
Dustless Crystal



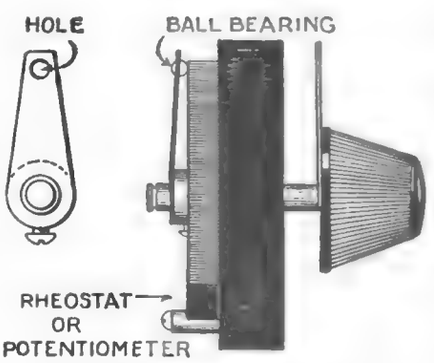
One of the greatest detriments to the best operation of a crystal detector is the collection of dust on the crystal itself. A mica disk with a hole pierced in the center, placed over the cup as shown above will prevent this accumulation and will in no way affect the operation and adjustment of the detector. The disk should be about ¾ of an inch larger in diameter than the cup.—Lowell Hammond, Rep. No. 18,939.

Soldering Aid



Soldering acid is a rather difficult material to keep around the shop and to keep out of trouble. If the system illustrated above is employed, no further trouble will be experienced. The soldering acid, after having been satisfactorily cut with zinc is placed in a bottle equipped with a rubber cork and a glass tube. The hole in the end of the tube is small enough to prevent a flow of the acid, but large enough to allow one drop to exude at a time. —Benjamin Hoopes.

Rheostat



To insure a smooth working rheostat, drill a small hole near the end of the arm as shown above and insert a ball bearing between the arm and the wire. The hole will keep it in position. Good contact will be made, and the operation will be smooth.—Salvadore Foley, Jr.

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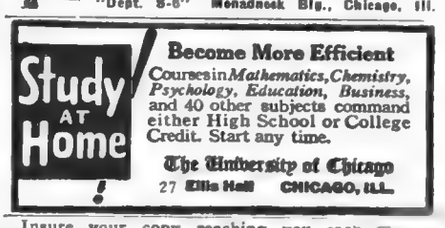
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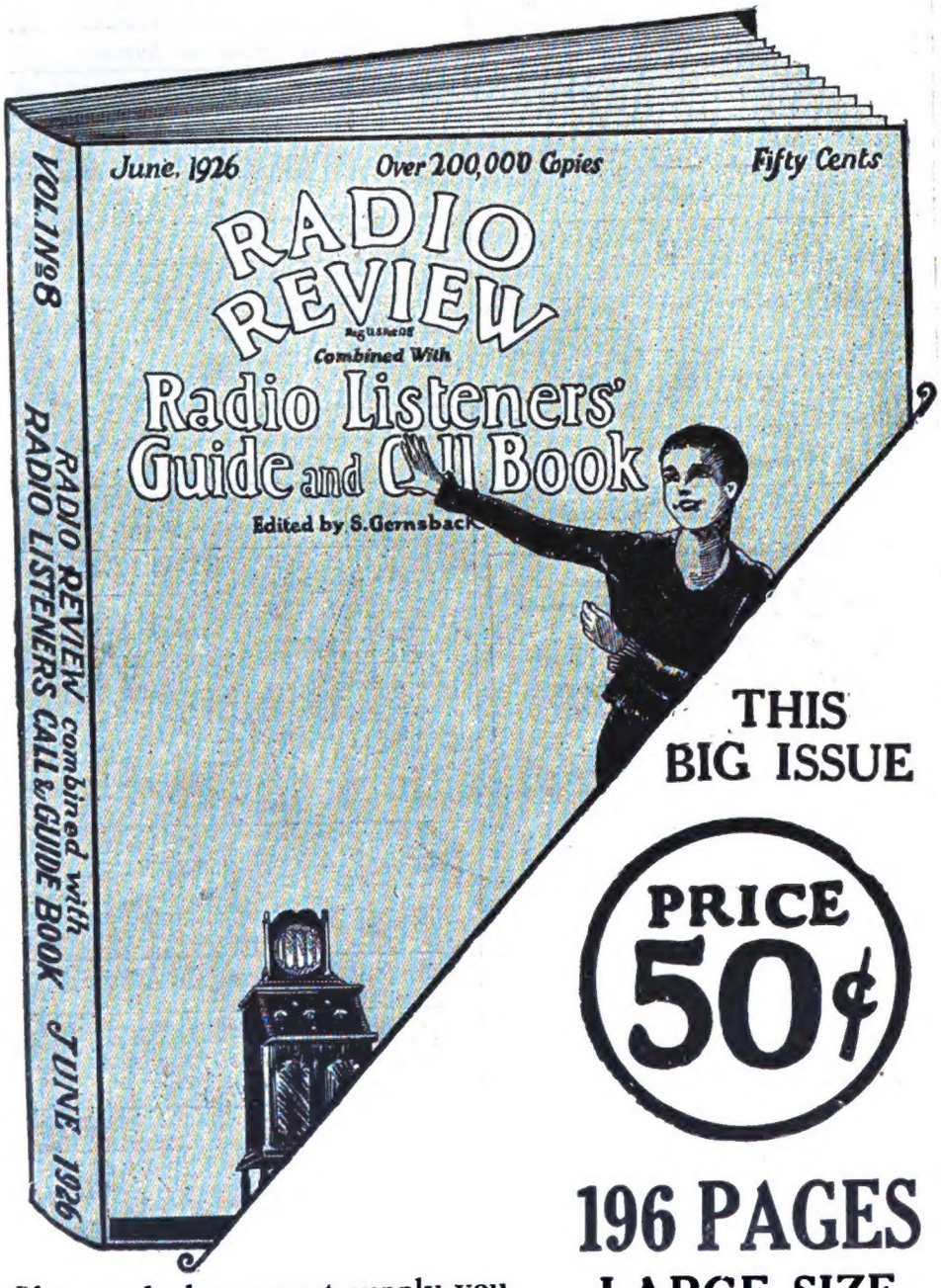
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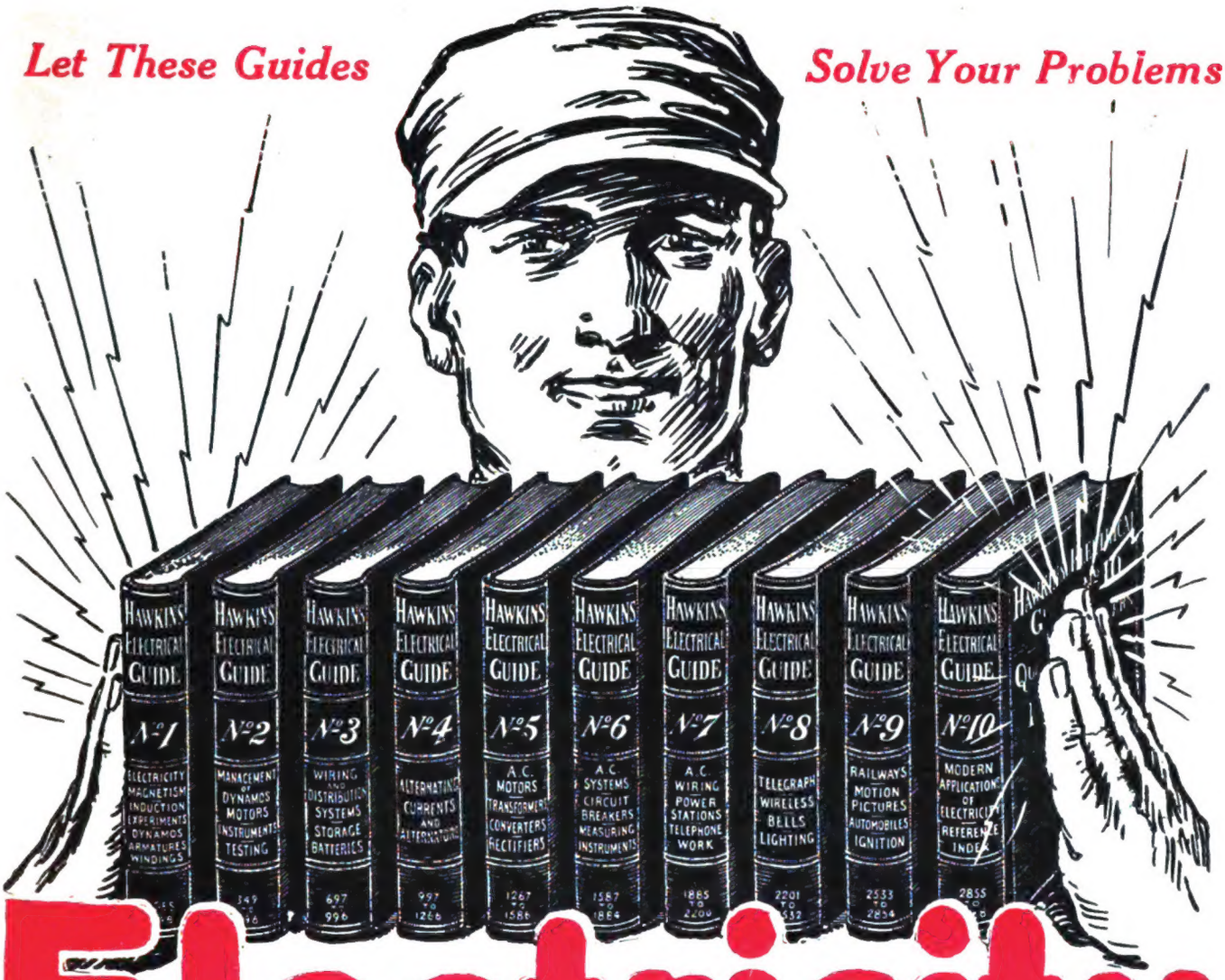

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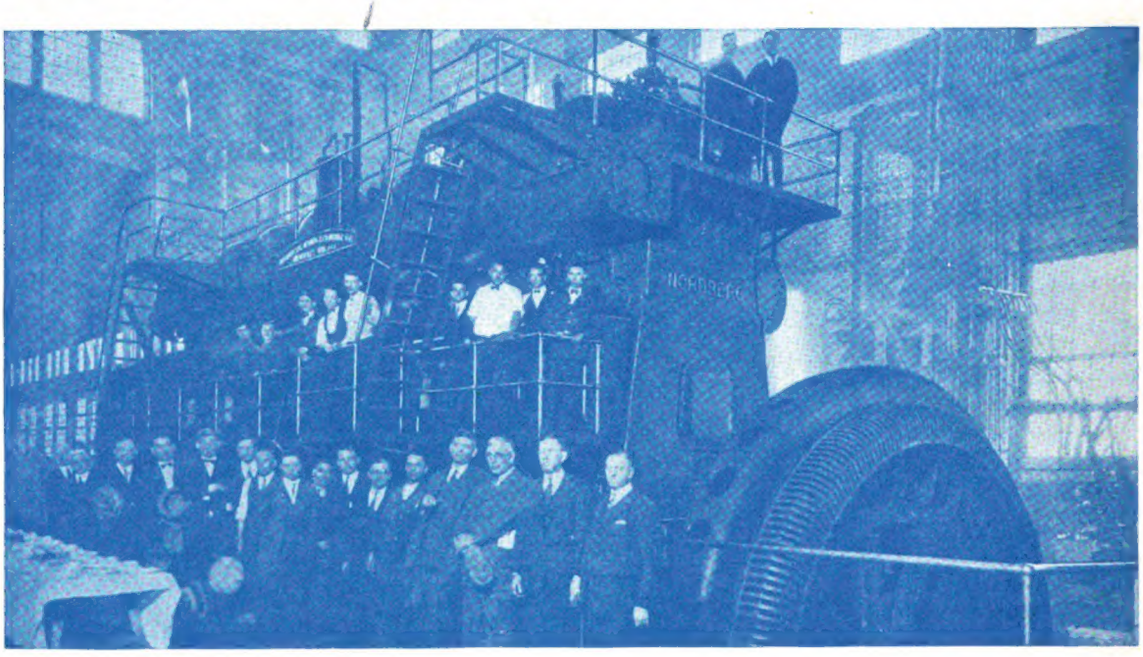

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